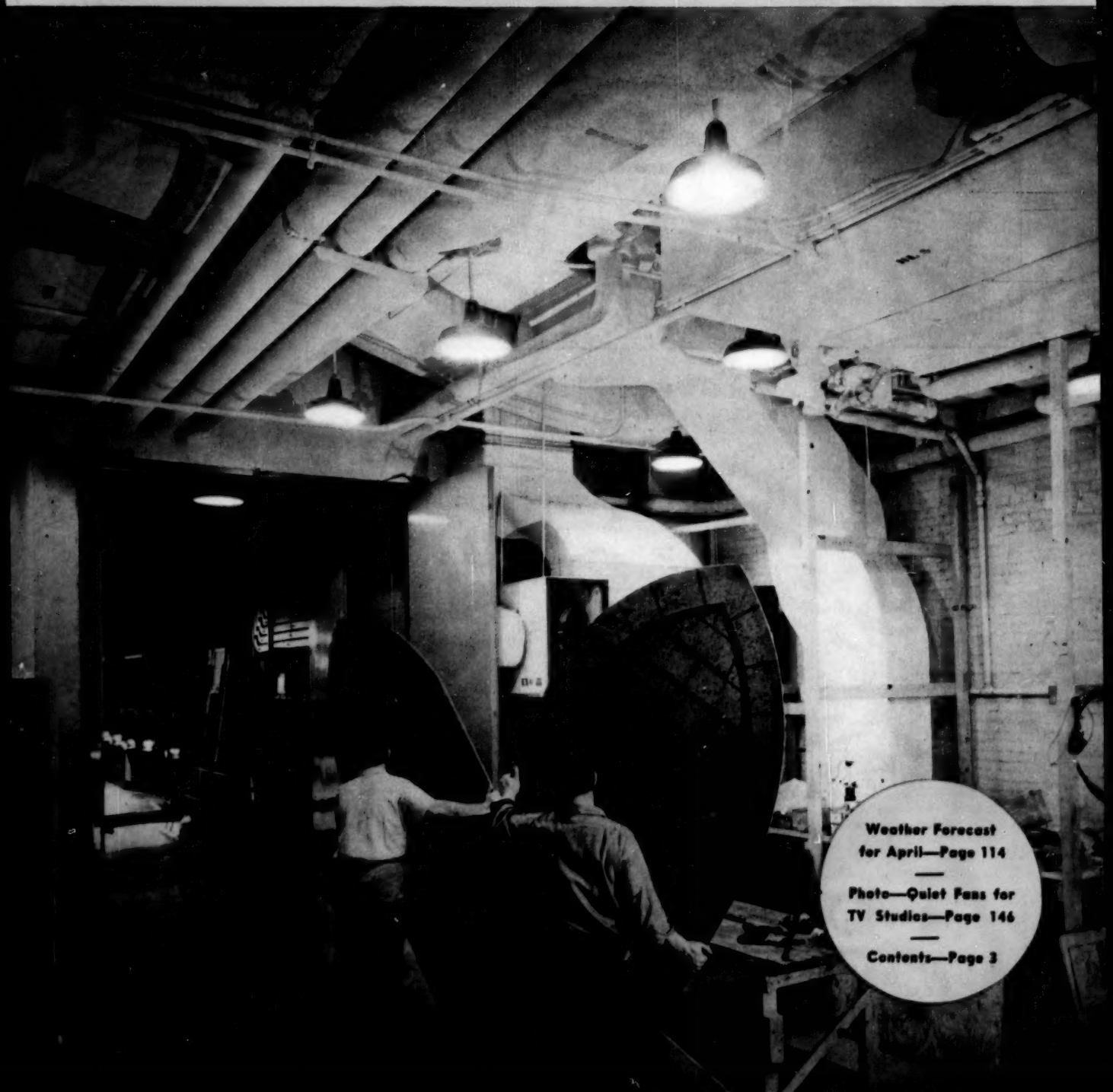
AIR CONDITIONING HEATING AND VENTILATING

APRIL, 1955—52nd YEAR



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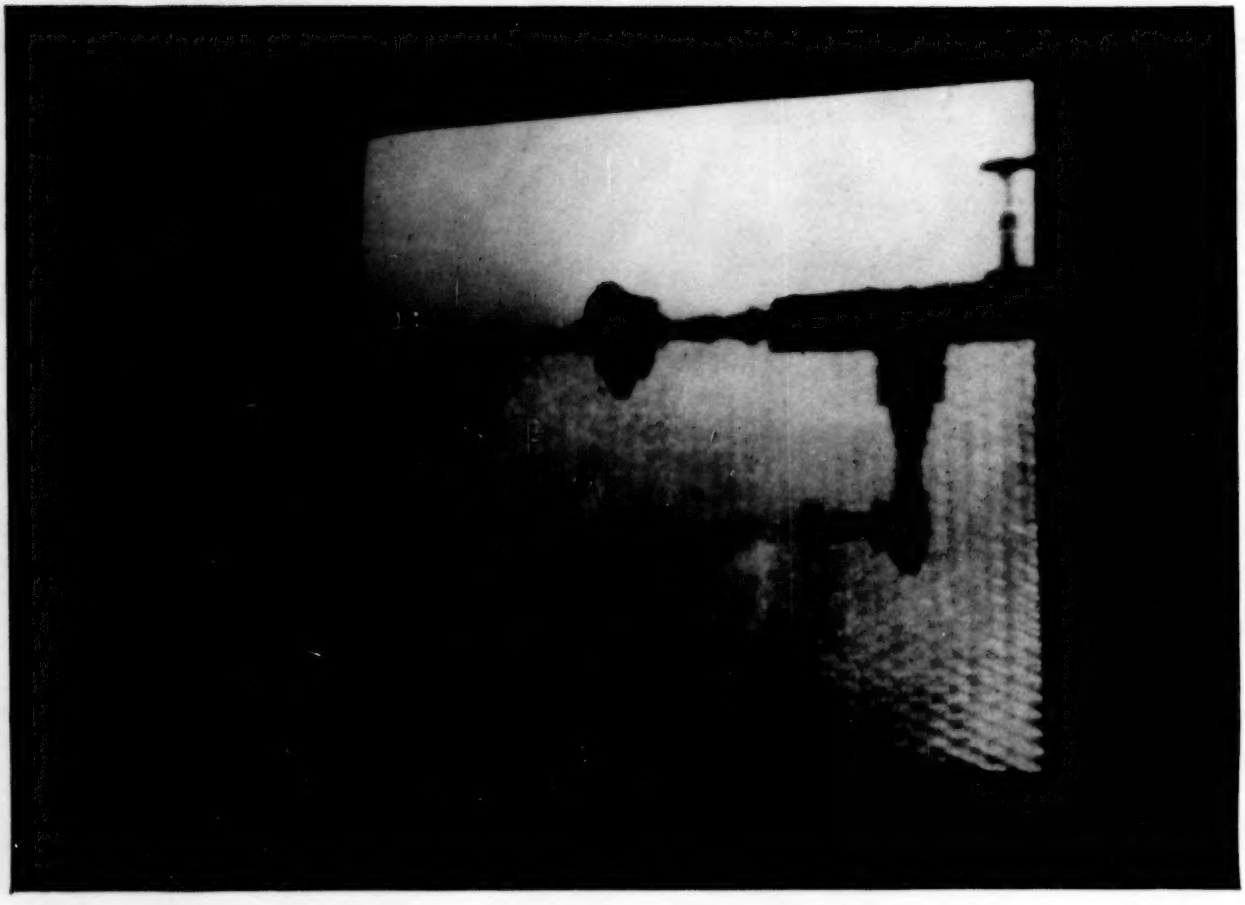
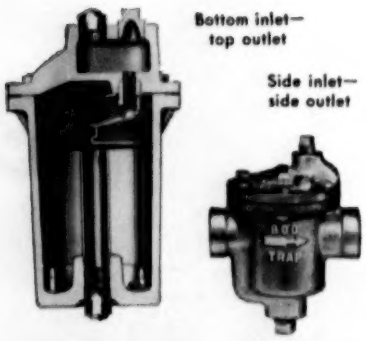


A Steam Trap Casts a Mighty Big Shadow



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Armstrong traps also cataloged in Sweets and Chemical Engineering Catalog.

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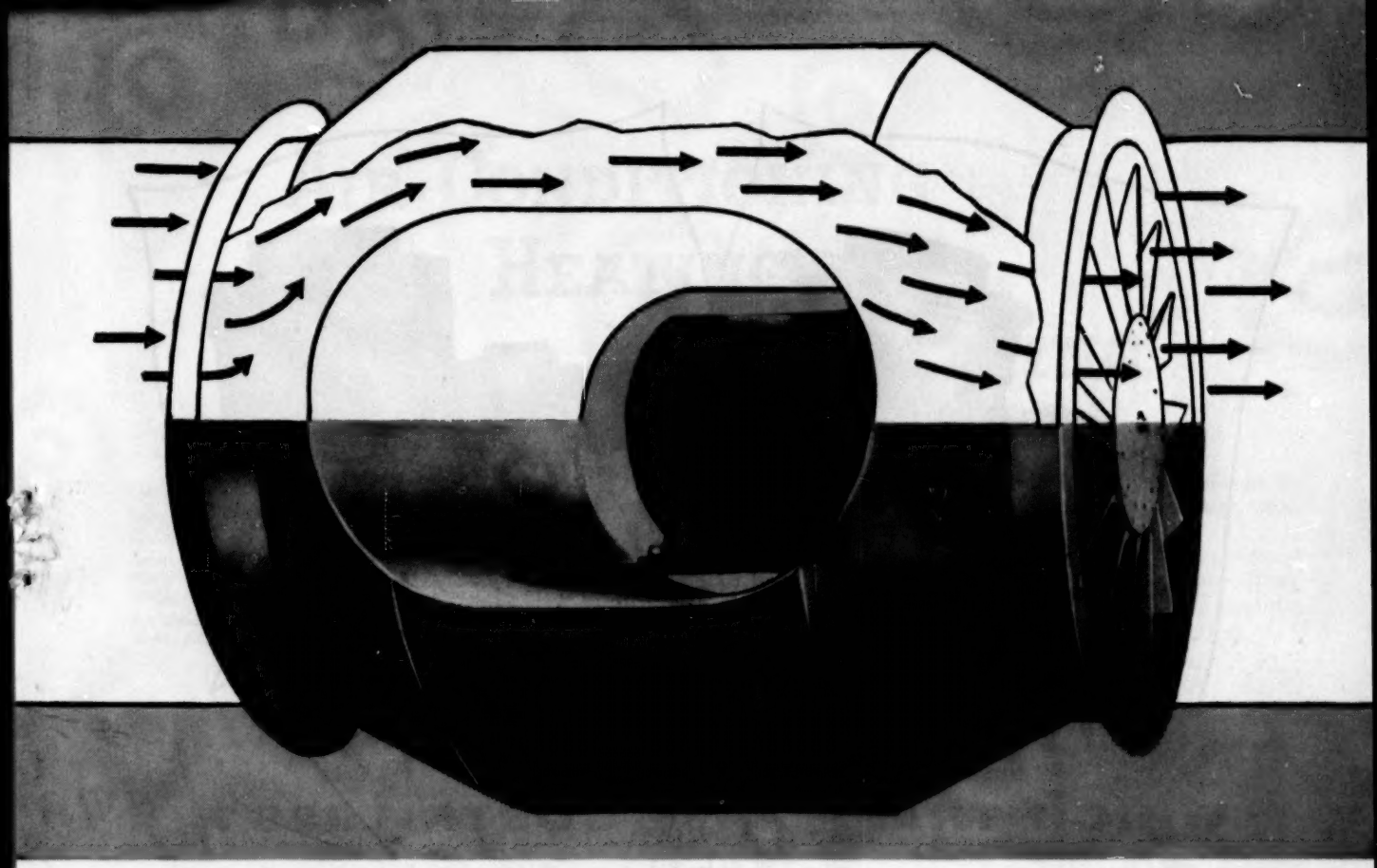

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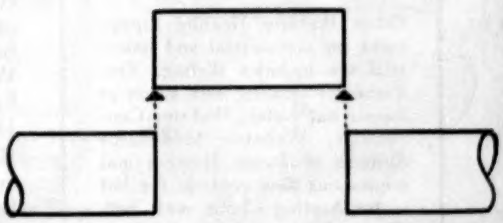
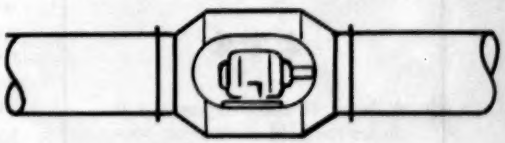


1. DUCT SECTION COMES OUT



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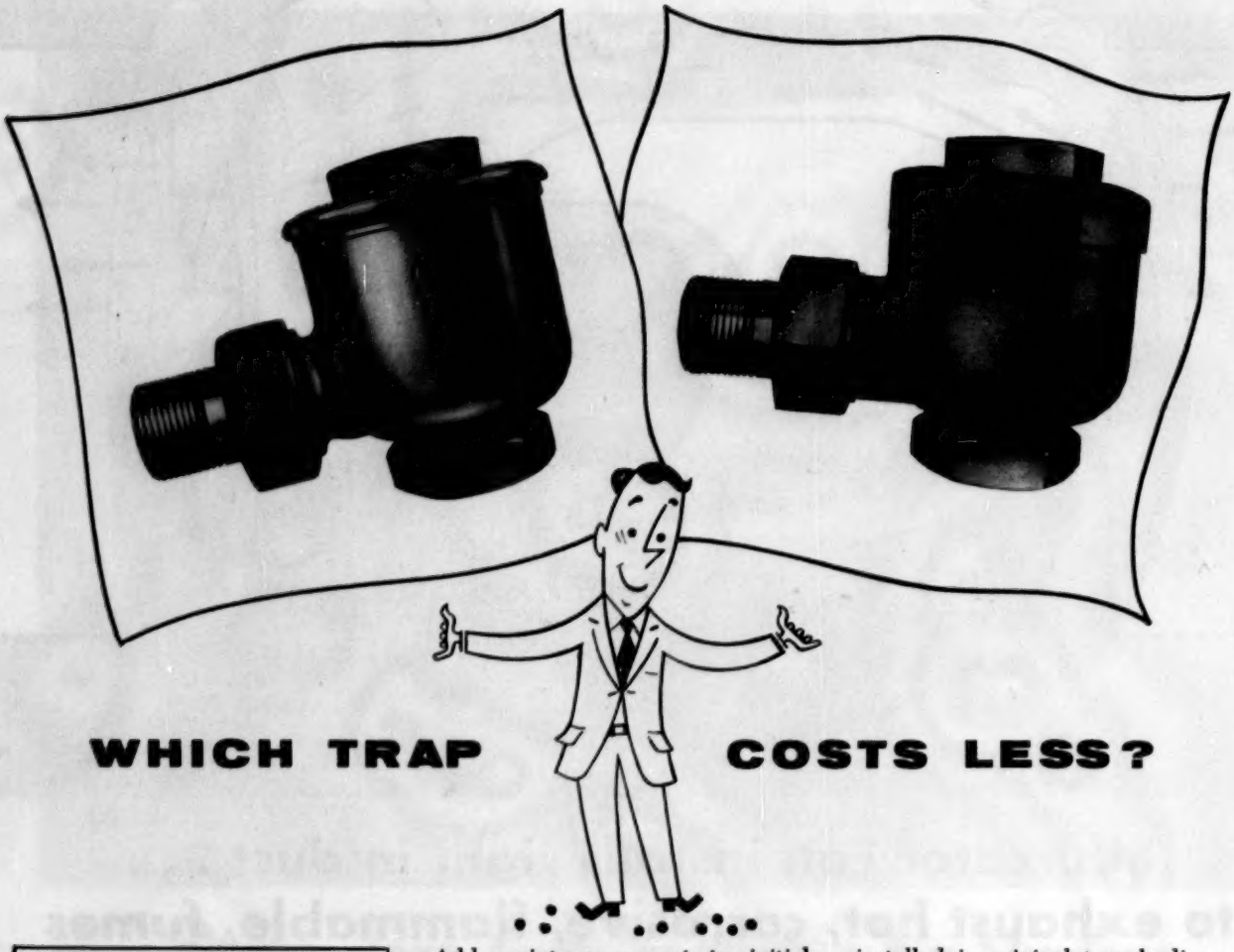

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Other Webster Heating Equipment for commercial and industrial use includes Webster Tru-Perimeter Heating with steam or forced hot water; Webster Convectors; Webster Moderator Systems of Steam Heating and continuous flow controls for hot water heating – both with outdoor thermostat; and Unit Heaters. Data on request.

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Webster Radiator Trap installations customarily give 15 to 30 years satisfactory service. A survey showed that 51,816 Webster traps in service averaged 30.3 years of service and were still going strong. Furthermore, in six installations, it cost less than one cent per year to maintain a Webster Trap. The average of 16 installations was only 2.8c per year.

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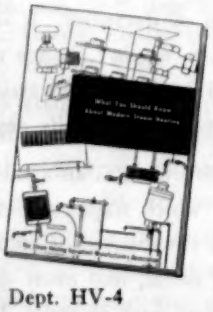
"What You Should Know About Modern Steam Heating" is the title of this new booklet of interest to engineers. Write on your letterhead for your copy.



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AIR CONDITIONING HEATING AND VENTILATING

APRIL, 1955

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Washington News

LORING F. OVERMAN

HOW a slight change in the political makeup of Congressional committees can result in an almost complete about-face in legislative proposals affecting business is being strikingly demonstrated on Capitol Hill.

As recently as last November, Business was a fair-haired boy in Washington. His whims were catered to, and his promises of increased prosperity for all through increased production was being accepted and encouraged.

Today, business in general and Big Business in particular, is suspect.

Rightly or wrongly, depending on the political point of view, tax inducements are subject to curtailment; the risk capital market of the stock exchange has been under suspicion and investigation; bigness in business is being made the special target of anti-trust studies, and in several pieces of legislation some observers point with alarm to what they consider the "danger" of vastly expanded federal controls.

A For Instance—Gas

Perhaps closest to the air conditioning, heating and ventilating industries are the present legislative proposals to control the price of natural gas at the wellhead. Several bills have been introduced to clarify present legislation to make certain whether the Federal Power Commission has authority to regulate the price of gas produced, as well as that moved in interstate commerce.

The present controversy goes back to 1938 when Congress passed the Natural Gas Act. It gave the Federal Power Commission authority to regulate prices of gas transmitted and sold in interstate commerce for resale. Congress specified that the law was not to apply "to the production and gathering of natural gas." The FPC interpreted the law as denying the agency authority to control prices of producers and gatherers of natural gas, and the majority of the FPC so ruled on 11 different occasions, the latest in 1951.

An attempt was made in the 1950 Congress to further clarify the law and to exempt federal control of prices at the producing level, but the legislation was vetoed.

The following year, 1951, the FPC majority, following its own precedent, ruled in the case of Wisconsin vs Phillips Petroleum Co. that the FPC lacked authority to control gas prices at the wellhead. Wisconsin appealed the decision to the courts and on June 7, 1954, the Supreme Court ruled, 5-3, that the Natural Gas Act does authorize the FPC to regulate prices of independent producers and gatherers.

Legislative proposals now under consideration have opposite purposes—some would make certain that controls at the well head are exempted; others would impose such controls. Proponents of the latter view contend that the government cannot effectively regulate prices for interstate transmission and sale of gas unless it also controls the prices of those producers.

Those who oppose this view hold that it would set a precedent for an entire new area of government control. They point out, for example, that in regulating railroad rates, there has never been any need for the Government to fix the prices of coal or oil that locomotives burn. Nor has it been seriously argued that because the government regulates airplane fares and airline subsidies, it should also control the price of aviation gasoline.

The idea of price control at the well is pointed to by opponents as a precedent which could be used by a control-minded administration to enter other fields of competitive enterprise.

Industry's Stake

What the controversy means to the air conditioning, heating and ventilating industries is apparent when the growth of the gas market is projected into the future. Here are some of the figures:

In 1946, gas supplied 14.5% of the mineral energy consumed in the U. S.—23.7% in 1953.

In 1953 there were 24,186,000 household gas customers, but only 15% of the homes outside the Southwest have been able to obtain natural gas. A recent tally showed a waiting list of 270,000 household consumers in four major cities—135,000 in Chicago alone.

Estimated 1957 demand for residential space heating alone is put at 50% over that of 1953.

Volume of commercial consumption (2,042,000 users in 1953) meanwhile is more than twice that of home consumption. Since 1945 the demand for gas has more than doubled, while proved reserves have increased less than 50%.

Producers argue that if federal controls of wellhead prices were imposed, incentives to develop new wells would be curtailed, or that producers would be encouraged to sell within their own states to avoid the burden of federal control.

Meanwhile the Federal Power Commission is proceeding with arrangements to assume the control which since 1938 it has contended it did not have. The FPC froze gas producers' prices as of June 7, 1954, date of the Supreme Court decision in the Phillips case, but some increases have already been allowed.

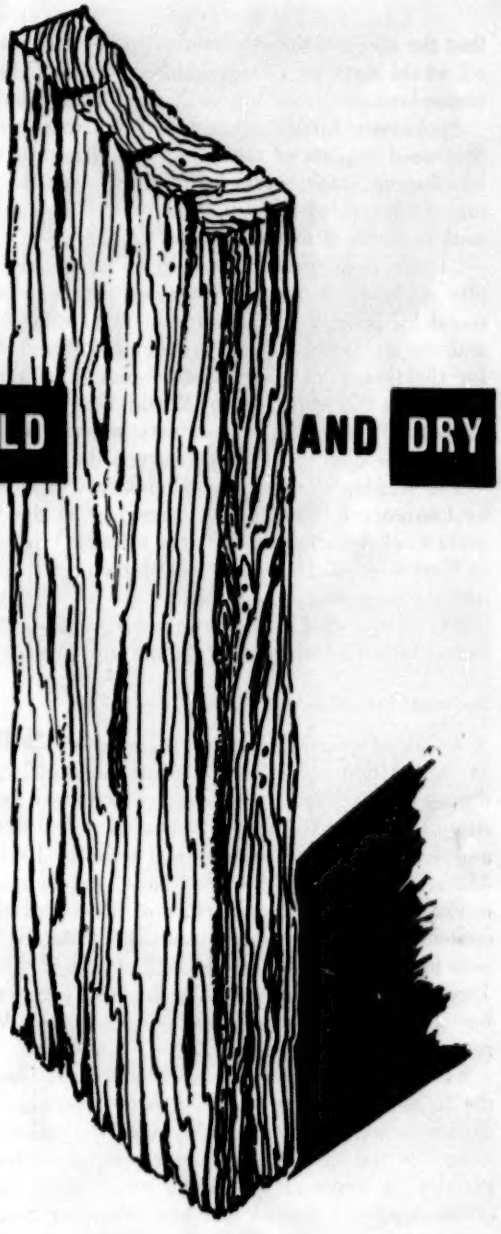
The arguments against wellhead control are summed up in a recent news letter of the National City Bank: "Thus, when all is said and done, the issue comes down to the question of the kind of economic system we believe in—one that is regulated by the government, or one that gives maximum scope to private initiative, enterprise and competition.

"In the gas industry, the producer's freedom to discover, develop, produce and sell his gas in a competitive market has been basic to the industries growth and ability to meet increasing demands. To change the rules now might seriously inhibit this progress, to the detriment of consumers and of the maintenance of a sound energy policy for the nation at large."

Oil Imports Protested

In another branch of the fuels industry, a Senate Labor Subcommittee investigating unemployment has been told

WOOD WON'T ROT WHEN IT'S COLD AND DRY



Living fungi, which break down the substance of wood are microscopic and abundant. But they need WARMTH and DAMPNESS to develop. Dampness will also peel off paint, crumble plaster, cause iron and steel to rust.

Some insulations can promote and retain destructive condensation inside walls and other structural spaces. Warmth and vapor can flow through asphalt, paper, plaster and most building materials, including ordinary insulations. Vapor condenses when, upon striking a colder surface, the air reaches a dew-point.

An empty space, the best insulator against heat flow by Conduction, does not prevent heat flow by Radiation and Convection. Of all heat transferred through structural spaces, about 50% to 80% is by Radiation; all but about 7% of the rest is Convection. The surfaces of multiple accordion aluminum sheets have a reflectivity for heat rays of 97%; absorptivity and emissivity of only 3%. The aluminum and fiber layers retard Convection. Conduction is slight through the preponderant low density air spaces.

The tough aluminum sheets in multiple accordion aluminum are almost completely impervious to water vapor, and are long and continuous. Infiltration under flat, stapled flanges is slight.

Where multiple accordion aluminum is used, fortuitous vapor and water (for instance rain) which intrude into wall and similar spaces will gradually flow out as vapor through exterior walls and roofs as pressure develops within, because vapor flows from areas of greater to less density. The vapor cannot back up through the continuous, almost completely impervious aluminum, so it flows out because exterior walls and roofs have substantial permeability in comparison to aluminum, far greater than the required 5 to 1 ratio.

To obtain maximum uniform depth protection against heat loss and condensation formation, it is necessary to use **edge-to-edge** multiple aluminum, **each** sheet of which automatically stretches from joist to joist, and also all through the flanges for further vapor protection as well as permanent attachment of each sheet.

The U.S. NATIONAL BUREAU OF STANDARDS brochure: "Moisture Condensation in Building Walls," discusses vapor and heat flow, and the causes and prevention of condensation. Use the coupon. Get a copy at our expense.

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that the elimination of excessive imports of residual fuel oil would serve as a "tremendous stimulant" in relieving unemployment in the oil, coal, and railroad industries.

Spokesmen for the oil and coal industries warned that continued imports of foreign oil would require the laying off of some 50,000 workers in oil fields and the continued unemployment of more than a quarter of a million persons in the coal fields.

"There is no greater tragedy or no greater loss than idle workers," said J. P. Coleman, president of the National Stripper Well Association, "We cannot sit idly by and see the American oil producing industry liquidated for the benefit of a few overly ambitious international companies. Since the end of World War II we have seen imports of crude oil and products increase from 300,000 barrels per day to 1,300,000 barrels daily.

The lagging domestic coal industry was characterized by Laurence E. Tierney, Jr., president of the West Virginia Coal Association, as "near collapse" in many parts of West Virginia because of "excessive imports of residual oil. He suggested that Congress act on the problem to make certain that a "reasonable relationship be maintained between imports and domestic production."

Business Tax Aids Attacked

As tax hearings progressed, Washington observers were convinced that several tax concessions made to business during the last Congress might be taken away by this one. Almost certain of repeal, it appeared, were Sections 452 and 462 of the Internal Revenue Code of 1954. Section 452 relates to prepaid income, and 462 to reserves for estimated expenses. Some critics of these provisions have contended that they would result in "windfalls" to business taxpayers of between $1 billion and $5 billion. The Treasury department considers this an exaggeration, but has given out no official estimates of possible loss of revenue.

Even while 452 and 462 were under consideration by the House, several members of the Senate were planning further amendments aimed at removing other "concessions" to business. One Senator was understood to be planning a move to repeal the dividend exclusion and credit provision passed last year. Another Senator had announced plans to move for the repeal of the accelerated depreciation provision; other diehards were planning a floor fight for individual income tax cuts.

Confederate Idea Up Again

Senator Byrd, Virginia Democrat whose insistence on government economy and a balanced budget has placed him on the side of the Administration in recent tax votes, has dug up a Confederate idea that he feels would still be good business. In the Confederate Constitution was a provision for an item veto on appropriation bills. It gave President Jefferson Davis authority to veto individual items of appropriations bills instead of having to veto the whole bill in order to get rid of a disliked item.

In 1876 a bill to include an item veto in the U. S. Constitution was proposed. Since then 100 similar attempts have failed, although 39 states have adopted the item veto. Without such a device, the President is virtually denied his constitutional right to veto appropriations bills. To get the money needed to run the government, he is required to accept some unwanted spending items.

Senator Byrd's plan (S.J. Res. 52) would amend the Constitution to authorize Congress to pass a law giving the President the item veto authority. If he vetoed more than one item of an appropriations bill, his action would be subject to Congressional over-riding by a two-thirds vote of both House and Senate. Also, Congress could repeal the law at any time. In presenting S.J. Res. 52, Senator Byrd has coupled his plan with another (S. Con. Res. 15) in which he is joined by 45 other Senators for a single-package appropriations bill to replace the present dozen bills.

Washington Miscellany

Tax Report Time Extended. The time for filing consolidated returns for taxable years ending on or after December 31, 1954, but before June 30, 1955, has been extended until September 15, 1955, it is announced by Internal Revenue Commissioner T. Coleman Andrews. Official text:

"The time for filing the return for a taxable year ending on or after December 31, 1954, but before June 30, 1955, by a corporation which is a member of an affiliated group having the privilege of making a consolidated return for such taxable year has been extended to September 15, 1955.

"Requests for an additional extension of time for filing such return beyond that set forth in the preceding paragraph to which the taxpayer may be entitled under Section 608 (1) (a) and (b) should be addressed to the District Director of the Internal Revenue District in which the consolidated return will be filed.

"This extension of time shall not be construed as an extension of time for payment of tax, nor as a waiver of liability for interest on any amount of tax due and unpaid as provided by law."

Veteran's Rights Clarified. The Supreme Court has ruled 7 to 1 that a reemployed veteran is entitled. under the Selective Service Act as amended, to count time spent in the armed forces as "experience" for the purpose of establishing his position on a seniority list used as the basis for promotion. The lower court had held that the veteran could count his military service as seniority for other purposes, but that only "actual time" spent on the job could be computed as experience. (Diehl v Lehigh Valley R.R., No. 246, March 14, 1955.)

Contingent Fee Sometimes OK. The Maryland Court of Appeals has ruled that a subcontractor may legally pay a contingent fee to obtain government business from a prime contractor. The Court holds that such bans, included in both Executive Order 9001 and the Armed Services Procurement Act, apply only to direct contractors.

Natural Gas Statistics Issued. The 1953 edition of Statistics on Natural Gas Companies was issued on March 14, 1955 by the Federal Power Commission. The report contains detailed financial and operational information for 160 companies. Copies of the report, (FPC S-114) at $5.00 each, are available through the FPC Publications Division, Washington 25, D. C. In about a month, a 22-page summary will be available at the same address.

Fuel Oil Tank Sludge Studied. The Bureau of Mines has issued a report, The Sludge Problem in No. 5 Fuel-Oil Tanks (R. I. 5113) available free from the Bureau.

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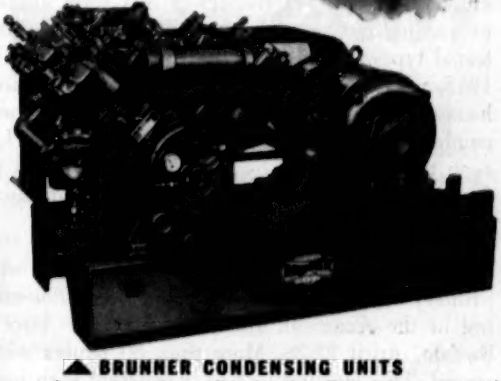

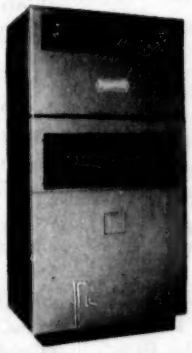

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- Proven Quality
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- Easy Servicing
- Warranted Performance
- Nearby Distributor Service
- Profit Opportunity
- Advertising Support
- Sales Promotion Help

BRIEFLY STATED

• Four new officers of Carrier Corp. were elected pursuant to the merger of Affiliated Gas Equipment, Inc., into Carrier Corp. Lyle C. Harvey, formerly president of Affiliated, was elected senior vice president and a director of Carrier Corp. and will direct its three new operating divisions, which will be known as Bryant, Day & Night and Payne. Other officers elected were Ronald N. Campbell, vice-president who will serve as general manager of the Bryant Division; Howard L. Clary, vice president who will be in charge of Bryant sales; and William J. Bailey, vice president who will head both Day & Night and Payne divisions.

• The General Electric Company has announced that it will build a new $15 million plant at Tyler, Texas, for the manufacture of home cooling units.

• American District Steam Company, Inc., of North Tonawanda, N. Y., has changed its name to ADSCO Industries, Inc., and has set up two new operating divisions. The North Tonawanda plant operation has become the American District Steam Division of ADSCO Industries, Inc., and the former California Steel Products Company of Richmond, Calif., the California Steel Products Division. The latter company was purchased by American District Steam Company a little over a year ago.

• The industry's first codes for determining the outputs of indirect water heaters are being issued by the Institute of Boiler and Radiator Manufacturers. Ratings based on tests carried out under either of the two codes will be known as I=W=H Ratings, a new term applied to approved indirect water heaters of either the internal or external types. The first of the two Codes, dated March 1, 1955, provides for I=W=H Ratings for indirect water heaters of the external or internal tankless type, used in combination with specific boilers. The second I=W=H, soon to be published by I=B=R, is intended primarily for indirect water heater manufacturers producing units of the external type, storage or tankless.

• Methods of safeguarding workers' health will be the primary subject for discussion at the forthcoming meeting of the American Industrial Hygiene Association in Buffalo, April 22-28. More than 60 papers will be presented. This meeting will be concurrent with meetings of the American Conference of Governmental Industrial Hygienists, American Association of Industrial Nurses, Industrial Medical Association, and the American Association of Industrial Dentists.

• At the annual meeting of the Fuel Oil and Water Heater Manufacturers' Association accomplishments of the first four years of its existance were reviewed by Henry S. Lewis, president. These include establishment of technical standards for materials and manufacturing practices for fuel oil heaters; acceptance of standards by insurance carriers; public acceptance of products bearing the Association label. In addition, technical research groups are in the process of establishing capacity and installation standards for all classes of water and all heat exchange equipment being manufactured by members of the Association.

• An order for 140 more freight car refrigeration units, placed by the Santa Fe Railway with The Trane Company of La Crosse, Wis., indicates that the number of mechanical reefers on U. S. railroads will virtually double during 1955. This order, one of the largest of its kind ever placed by a single railroad, raises to 580 the number of mechanically refrigerated cars being built by railroads, railway-owned private car lines, or private shippers. A total of 675 such cars were already in service on February 1, 1955.

• A half-million-dollar laboratory for research into Freon fluorinated hydrocarbon compounds and their applications in refrigeration, aerosols, plastics, and miscellaneous fields will be built by the Du Pont Company at Chestnut Run, near Wilmington, Del. The new facilities will provide laboratory and office space for the Kinetic Chemicals Division. Office space will be conditioned by a 15-ton heat pump.

• Perfection Stove Company stockholders at their annual meeting March 8 voted to change the name of the company to Perfection Industries, Inc. It was pointed out that the scope of the company's operations, since adoption of the present name in 1925, has been substantially broadened. At the present time Perfection's business is concerned with a number of other products in addition to the ranges and cook stoves which were originally manufactured. These include furnaces, space heaters, water heaters, winterization equipment, air conditioners, aircraft parts and other military equipment.

• Production has been initiated on two new aluminum welded tube mills at the Aluminum Company of America works in Alcoa, Tenn. The new mills provide Alcoa with the capacity to produce welded aluminum tube and pipe from ½-inch to 8-inch diameter. One of the mills will produce tube from ½-inch to 4-inch OD; and the other can make tube from 2-inch to 8-inch.

• Grinnell Company, Inc., of Providence, R. I., announces the appointment of E. M. Pease as manager of its Industrial Piping Division. A graduate of Duke University's Engineering School, he started with Grinnell Company at Providence in 1934.

• Appointment of John G. Dobson as vice-president of American District Steam Co., Inc. and general manager of the corporation's plant at North Tonawanda, New York, has been announced. Mr. Dobson, a graduate ME of Cornell University, also received his LLB at Fordham University; is a member of the New York State Bar, is a registered professional engineer in the State of New Jersey, and comes to ADSCO from The Foxboro Company, Foxboro, Mass., where he was manager of their Chemical Industries Division.

• Harry M. Pier, formerly general sales manager of Research-Cottrell, Inc., has been appointed special assistant to the chairman of the board to conduct new studies in the field of atmospheric pollution. Mr. Pier will coordinate the activities of Research-Cottrell, Inc. with those of industry, research and educational institutions and other interested organizations in this field. Charles E. Beaver, formerly assistant sales manager, succeeds Mr. Pier as general sales manager of Research-Cottrell, Inc.

WHO WOULD DARE TO GAMBLE WITH HER SAFETY?

On one thing everyone is united: protection of the school age youngster. Woe unto the man who would gamble on the safety or health of the boys and girls who hold the promise of tomorrow!

But despite the fact that old America is solidly united on the need for protecting young America, some hazards, less obscure but no less real than traffic, fire or health dangers, are sometimes overlooked.

An excellent example is the unprotected heating or power boiler in school buildings. It is the duty of every heating man to point this out to the proper authorities.

No field is more receptive to your counsel. No field offers you a better opportunity to be of real service to your community.

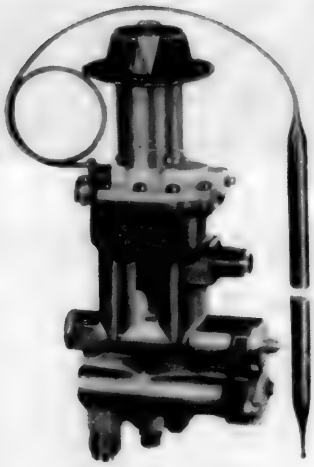
There are McDonnell safety devices for every type and size of heating boiler and hot water plant found in schools, operating at any pressure up to 250 lbs. A number of them are illustrated here. Ask for complete catalog.

McDONNELL & MILLER, INC., 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

McDONNELL *Boiler Water Level Controls*

NOW . . . AMERICAN-STANDARD REMOTAIRE HEATING-COOLING UNITS



are available with an automatic control that holds room temperature steady both summer and winter

Individual Remotaire Room Conditioners equipped with the new Selectaflow Control maintain *even* room temperatures all year 'round. The completely self-contained control changes over from summer to winter automatically . . . manual adjustments are not necessary.

The Selectaflow Control maintains even room temperatures by modulating the flow of either hot or cold water through the Remotaire Room Conditioner coils. Since the Remotaire unit's fan operates continually, the heating and cooling operation is smooth and even.

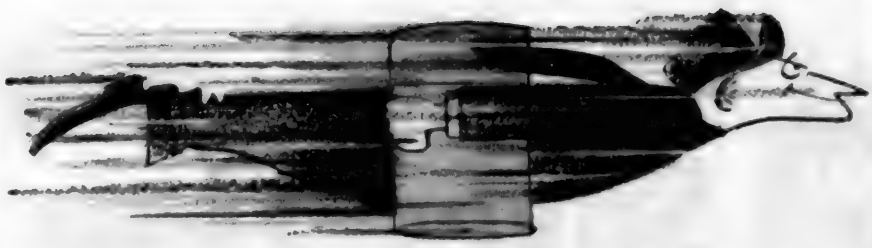
The Selectaflow is a mechanical control—requires no electrical connections—so installation is quick and easy. It can be installed in any Remotaire Room Conditioner. However, if exact temperature control is not essential in every room of the building, it can be installed in critical areas only.

For more information about the complete central plant Remotaire Heating-Cooling System, and the new Selectaflow Control, see your American-Standard sales office or write to **American Radiator & Standard Sanitary Corporation,** P. O. Box 1226, Pittsburgh 30, Pennsylvania.

AMERICAN-Standard

WATER HEATING - COOLING SYSTEMS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

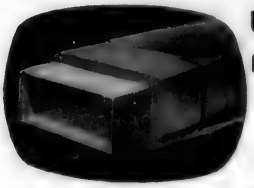


When you need insulation **right now**

call your ULTRALITE *distributor!*

Ultralite Duct Insulation and Duct Liner are stocked at *more* points throughout the country than any other glass fiber insulation And G-B's nationwide network of distributors is geared to give you "right-now" service and delivery.

So get acquainted now with your local Ultralite distributor. You'll find him listed in the Yellow Pages under "Gustin-Bacon Insulations" in all cities shown in the adjoining column.

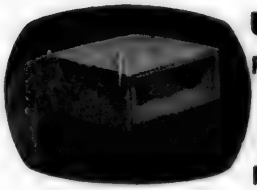


ULTRALITE DUCT INSULATION

FIRST flexible duct insulation of fine glass fibers on the market! Only Ultralite, introduced in 1945, has a **10-year record** of completely satisfactory performance.

FIRST flexible duct insulation of fine glass fibers available with factory-applied vapor barrier Ultralite is still available plain or with a wide choice of facings—some for appearance, some as vapor barriers.

FIRST flexible glass fiber insulation to spring back to full original thickness after being compressed!



ULTRALITE DUCT LINER

FIRST flexible duct liner of fine glass fibers. Recent examinations of Ultralite Duct Liner installed 7 years ago show no indications of air erosion.

FIRST flexible duct liner on the market with spray coating (1948).

FIRST flexible glass fiber insulation available nationwide at convenient stocking points for **immediate delivery.** And Ultralite is still available **more** readily, in **more** cities. than any other glass fiber insulation!

GUSTIN gb BACON **GUSTIN-BACON**

Manufacturing Company

Thermal and acoustical glass fiber insulations • Pipe Coupllngs and fittings • Molded glass fiber pipe insulation

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GUSTIN-BACON GLASS FIBER INSULATIONS

Industrial glass fiber thermal and acoustical insulations in blanket form and moulded pipe coverings. Light in weight, permanent, fire-resistant. Ultralite - Ultrafine - Ultracoustic - G-B Snap-On Pipe Insulation.

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Your nearest distributor is listed in the yellow pages of the telephone directory in the following cities.

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BIRMINGHAM, Alabama
BOSTON, Massachusetts
BUFFALO, New York
CHARLESTON, West Virginia
CHICAGO, Illinois
CINCINNATI, Ohio
CLEVELAND, Ohio
COLUMBIA, South Carolina
COLUMBUS, Ohio
DALLAS, Texas
DAVENPORT, Iowa
DENVER, Colorado
DETROIT, Michigan
EL PASO, Texas
FARGO, North Dakota.
FORT WAYNE, Indiana
FORT WORTH, Texas
HOUSTON, Texas
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JACKSONVILLE, Florida
JOPLIN, Missouri
KANSAS CITY, Missouri
LOS ANGELES, California
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MILWAUKEE, Wisconsin
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This 3-Way Saves Time.

ALLIS-CHALMERS
EQUIPMENT FOR
Air Conditioning

1 Coordinated Equipment

End the worry of coordinating three sources of supply. With Allis-Chalmers control-motor-drive combination, one reliable supplier guarantees the complete drive. All components are shipped from one supplier, arrive ready to be installed.

For one source . . . one responsibility, get Allis-Chalmers complete service, from power line to driven shaft.

2 Engineering Help

An experienced Allis-Chalmers distributor or district representative is ready to help you engineer the complete drive. This can make the job easier and more profitable for you. Components are designed to work together. One specification, one set of calculations — one order brings you the complete drive.

ALLIS-

Drive Combination . . . Money . . . Trouble!

3

Near you there's an adequate stock of drive components commonly used in air conditioning installations. Stocks are maintained by Allis-Chalmers Authorized Distributors and Regional Offices. In addition, an efficient warehouse inventory system locates hard-to-get items within hours after you call.

There's an A-C Certified Service Shop near you, too. There are nearly one hundred independent service shops which meet strict Allis-Chalmers standards for modern equipment, efficient methods and business integrity. These shops use factory-approved parts and methods.

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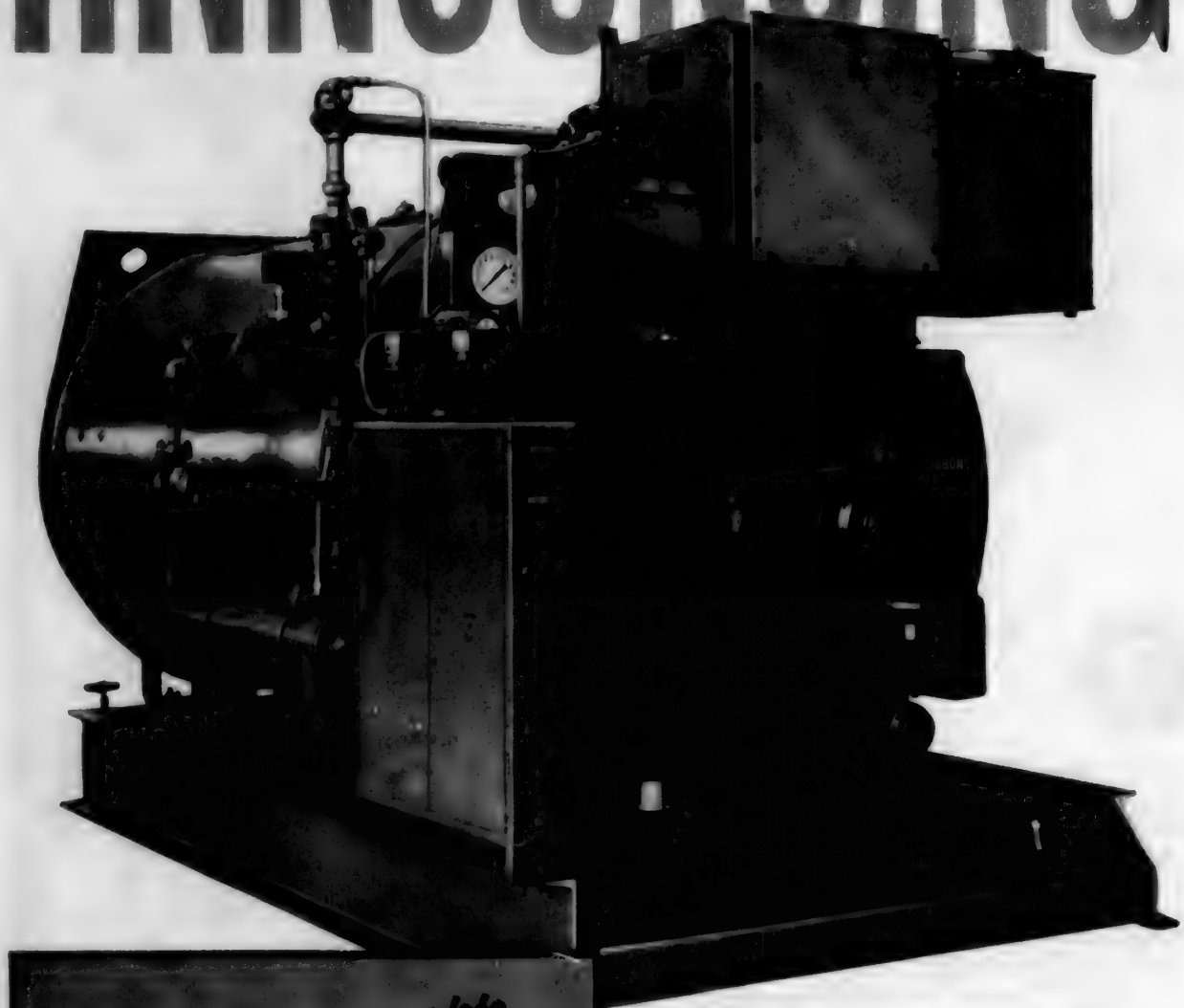
ANNOUNCING

FITZGIBBONS *Packaged* BOILER UNIT



A coordinated, complete low pressure heating package fire-tested and shipped as a unit!

REAR FURNACE WALLS COMPLETELY WATER JACKETED NO REAR WALL REFRACTORY NEEDED

- Induced draft for cleaner, quieter operation.
- Fully automatic for oil, gas or combination.
- 80% efficiency certified at gross output.
- Compact – Minimum clearance only needed at rear and one side.
- Rated on basis of 8.2 sq. ft. heating surface per boiler hp. with guaranteed gross output based on 5.0 sq. ft. heating surface per boiler hp.

Catalog FPB-10 gives complete details.
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The Fitzgibbons Boiler®

COPPER

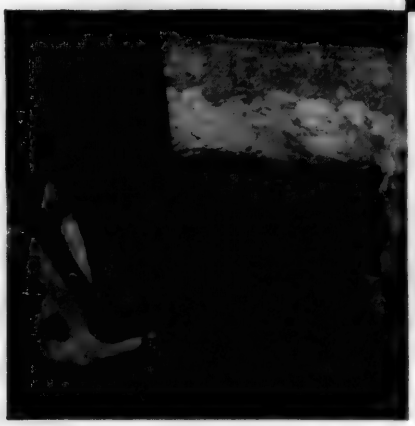
AIR CONDITIONING LINES

HOTEL IRVIN COBB

PADUCAH, KY,

Consulting Engineers: FERRIS & HAMIG, St. Louis. Mechanical Contractors: SHELBY SKIPWITH, INC., Memphis, Tenn. Revere Distributor: HENRY A. PETTER SUPPLY CO., Paducah, Ky.

Photo at right shows lines of Revere Copper Water Tube extending through ceiling. Just figure the time and trouble that would have been involved if threads would have had to be cut and wrenches used. You never have to worry about wrench room with Revere Copper Water Tube and solder fittings. You can work in the most confined spaces with ease. Also, you are assured of joints that stay tight.



Revere Copper Mains extending through floor. More than 6,180 feet of Revere Copper Tube was used in sizes ranging from ½" to 2". A 250-ton cooling unit takes care of the air conditioning of each guest room by a separate, individually controlled room unit.

● The Hotel Irvin Cobb, first existing hotel in the State of Kentucky to be completely air conditioned, is still another fine example of how well copper tube fits into the installation of air conditioning equipment. This is particularly true in existing buildings where working space is at a premium and where it is desired that only the absolute minimum amount of ripping up and redecorating be done.

Then, too, Revere Copper Water Tube has the added advantages of being non-rusting, light in weight, easy to handle . . . requires fewer fittings, less time for connecting and no need for threading. Cost? Many contractors tell us that copper costs *less* than rustable materials. So why take chances? Keep out of trouble with enduring, non-rusting Revere Copper Water Tube.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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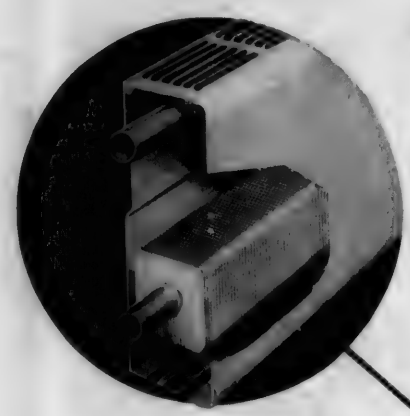
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y. Sales Offices in Principal Cities, Distributors Everywhere.

a new major advancement...

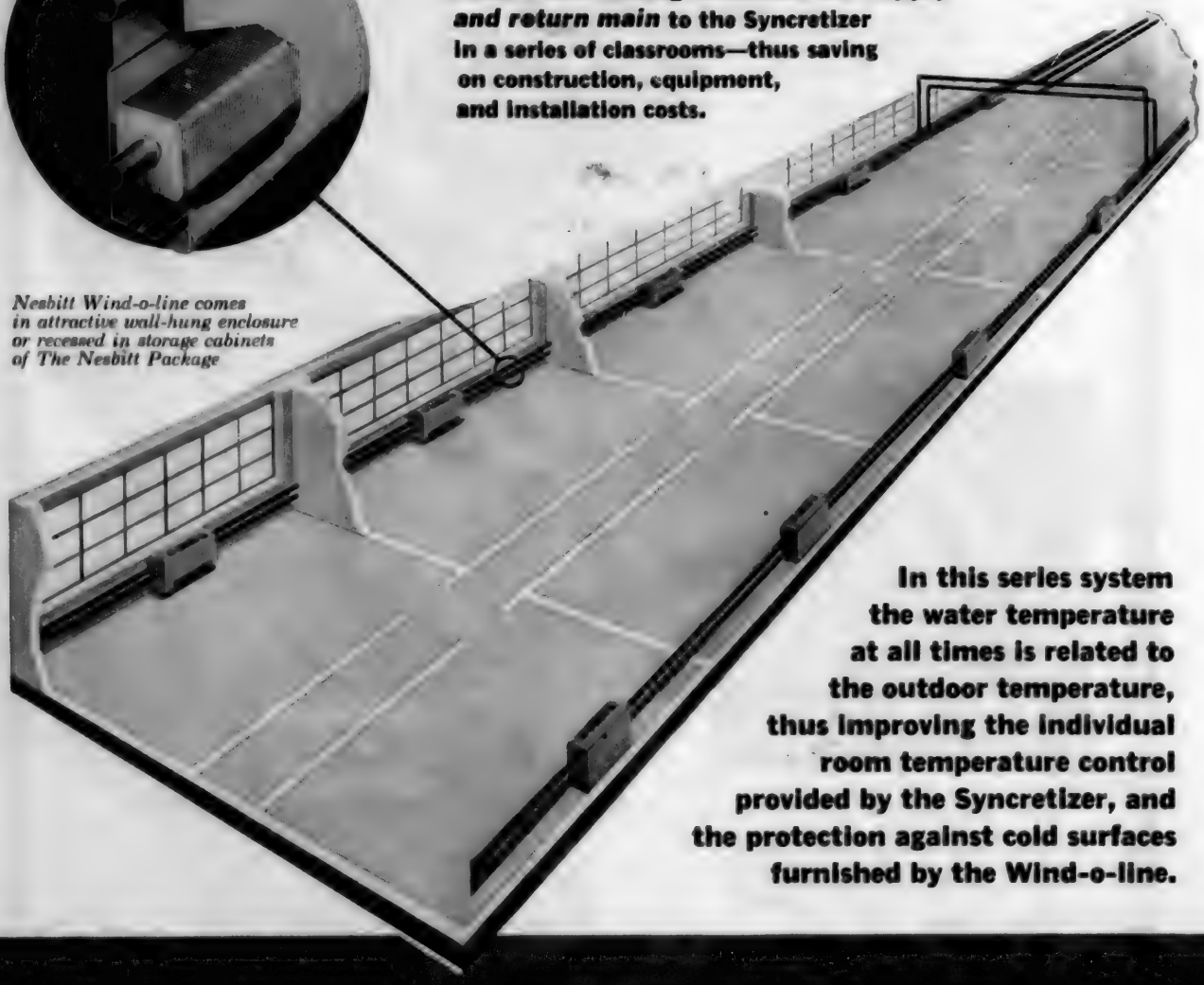
Nesbitt

SERIES HOT WATER



Nesbitt Wind-o-line comes in attractive wall-hung enclosure or recessed in storage cabinets of The Nesbitt Package

Nesbitt Syncretizers and Wind-o-line may now be combined in a forced hot water heating and ventilating system in which the *Wind-o-line tubing becomes the supply and return main* to the Syncretizer in a series of classrooms—thus saving on construction, equipment, and installation costs.

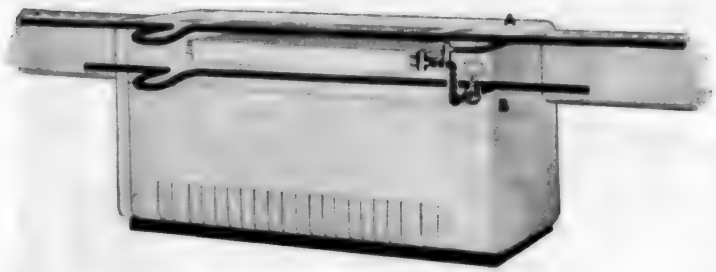


In this series system the water temperature at all times is related to the outdoor temperature, thus improving the individual room temperature control provided by the Syncretizer, and the protection against cold surfaces furnished by the Wind-o-line.

school mechanical system costs **reduced**

classroom comfort and protection **increased**

WIND·O·LINE SYSTEM



Packaged piping reduces installation cost. (a) Crossover return tubing, expansion loop, and air vent fitting come pre-assembled and connected to the heating element. (b) Crossover supply tubing, expansion loop, and balancing valve are furnished installed, leaving a minimum of piping at the site.

IF YOU are interested in school construction costs, it will pay you to study how this latest Nesbitt development meets today's needs and gives more for the school-building dollar.

In forced hot water applications Nesbitt Syncretizer heating and ventilating units with Wind-o-line radiation may be installed in series-loop circuits, in which the copper tubing of the Wind-o-line system serves as the only required supply and return piping for multiple-classroom groupings or entire wings.

COSTS REDUCED *Savings in equipment:* Smaller pipes and pumps are required because the Nesbitt System is designed to provide the needed heating capacity with water quantities of from one half to one third those required in conventional systems. Saves on both first cost and operating cost.

Savings in construction: Wind-o-line supplies Syncretizers, eliminating costly pipe trenches, mains, runouts and pipe covering in much of the building. Other piping is simplified.

Savings in installation: Mains and piping are smaller, shorter, simpler. Packaged piping within the Nesbitt Syncretizer unit ventilator reduces installation labor at the site. See above.

COMFORT INCREASED *Variable water temperature control:* Relating the available heat directly to outdoor temperatures improves the control of individual room temperature by the Syncretizer.

Improved cold surface protection: Because the system water temperature increases as outside temperature falls, Wind-o-line protection against cold window downdraft and bodily heat loss is continuously related to actual needs.

Off-time temperature maintenance: Without additional investment in equipment, the Nesbitt System maintains safe basic building temperatures during overnight, holiday, week-end shutdowns.

The Series Wind-o-line System offers you these

advantages

Better room temperature control

Increased protection against cold surfaces and window downdraft

Costly pipe trenches eliminated

Pipe covering and traps eliminated

Smaller pumps cost less, operate with greater economy

Shorter, simpler mains and piping

Packaged piping in the Syncretizer reduces installation costs

No extra controls and equipment required for night heating

[redacted]

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As You Like It!

Only AAF Offers Electronic Precipitators in a Range of Efficiencies with a Choice of Maintenance Methods

LOOK them over! This is AAF's line of electronic precipitators. All are highly effective in the removal of dust and smoke. But each was designed with a different group of needs in mind. Efficiency ratios, maintenance methods, air volumes, space requirements and initial cost are all vital factors that vary with individual jobs. That's why AAF offers you the proven benefits of electronic precipitators in three distinct "packages"—one of which is certain to solve your air cleaning problems in the manner and at the cost that insures a maximum return on your "clean air investment".

For complete product information, call your local AAF representative or fill out and mail coupon.

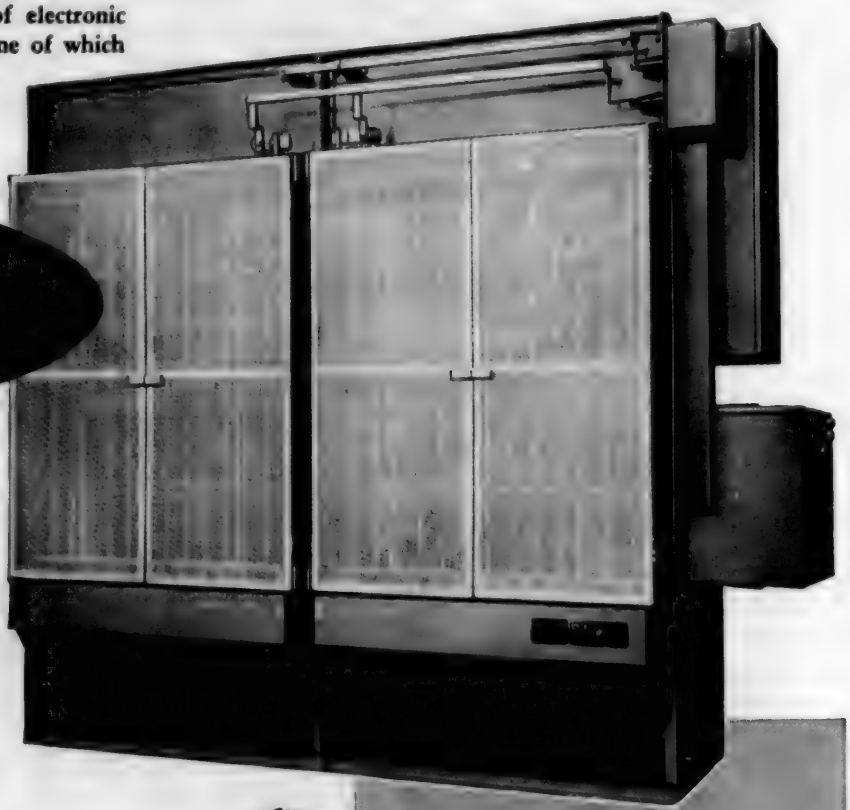
NEW!

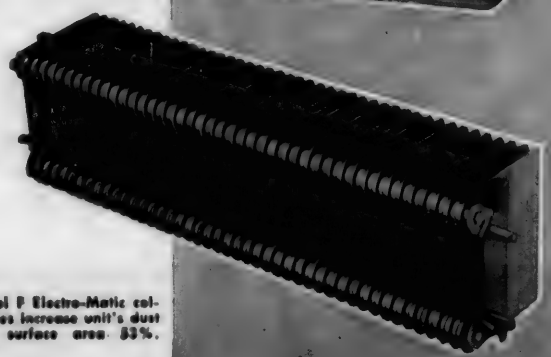
AAF MODEL F

Electro-MATIC

For 'Round the Clock Delivery Of Uniformly Clean Air

HERE'S the "robot" of modern electronic precipitators. The Model F Electro-Matic's high efficiency remains constant because of continuous, self-cleaning action. There's no dependence on the whims of a maintenance crew—no time out for washing down plates with hot water—no need for extra water and sewer connections. Electro-Matic's collector plates are automatically cleaned and re-oiled daily—are always in peak condition for the precipitation of dust and smoke particles. New type collector plates increase surface area 53% to further reduce possibility of dust build-up and insure constant low resistance.

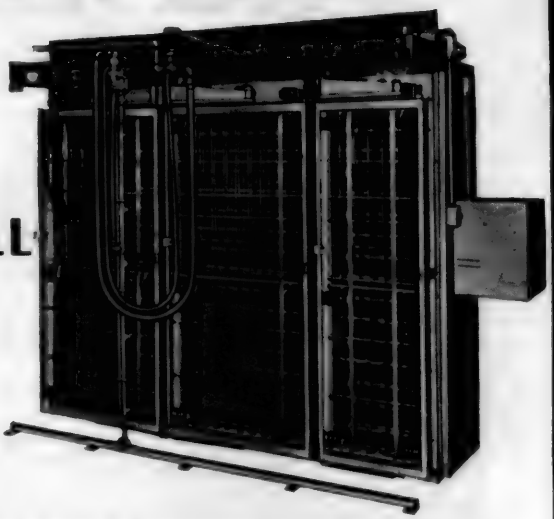




New Model F Electro-Matic collector plates increase unit's dust collecting surface area 53%.

CLEANING

AAF BETTER AIR IS OUR BUSINESS!

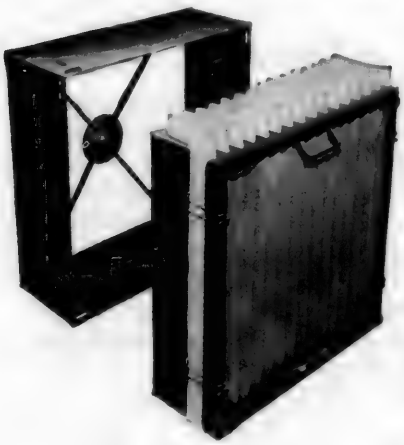


Electro·CELL

With TYPE H WASHER

Featuring "Push-Button" Maintenance

A stationary, plate-type electronic precipitator which, with the addition of the Type H Washer, provides for the washing and re-oiling of collector plates by two sets of traveling spray nozzles. Both operations are fully automatic after starting button is pushed. If manual cleaning is preferred, plates may be serviced in place or easily removed for inspection.

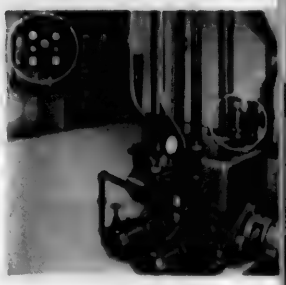


Electro·PL

The Low Cost, Dry-Type Electronic Filter

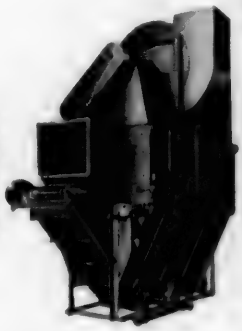
This electronic air filter offers double protection in that its Airmat paper media continues to filter the air even if the electronic action becomes inactive. When the low cost Airmat paper has accumulated a full dust load, it is discarded and easily replaced with clean media which returns the filter to its original efficiency. An Electro-PL Unit consists of a frame and collector element. By riveting frames together, units are quickly assembled into straight bank or "V" arrangement.

Illinois
Selectotherm — an automatically controlled high vacuum steam heating system which, through single dial control, balances heat supply against heat loss to provide even, constant warmth.



herman nelson
Unit Blowers — a new, diversified line of direct and belt driven centrifugal fans available in a wide range of wheel diameters and capacities.

AAF Type H ROTO-CLONE—a high efficiency hydro-static precipitator designed for the collection of both coarse particles and extreme fines in excessive concentrations. Available in exhaust volumes up to 50,000 cfm.



AAF herman nelson

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I would appreciate receiving catalogs describing the following equipment—

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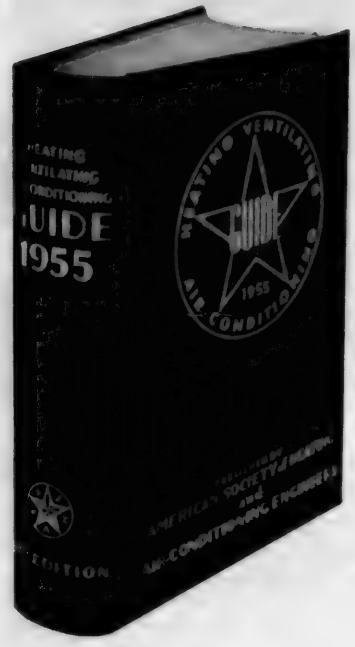

Published by the AMERICAN SOCIETY of HEATING and AIR-CONDITIONING ENGINEERS this indispensable book is revised and edited each year to make it the most demanded volume on heating, ventilating and air conditioning. THE GUIDE 1955 is a must for your office.

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The Master Reference

The new, enlarged GUIDE 1955 is a source of accurate heating, ventilating and air conditioning technical information for daily usage by engineers, contractors, dealers and manufacturers. Each of the 53 chapters contains a detailed and exhaustive discussion and these chapters are divided into 7 sections for easier reference. In addition there is a Catalog Data Section containing product information on over 325 manufacturers.

Helpful to Many

The contractor planning or estimating a heating or air conditioning installation, the engineer in need of technical data while designing and specifying for an installation, and the manufacturer urgently in need of particular information will find that THE GUIDE can provide the answers quickly and concisely.

What It Contains

7 sections covering Fundamentals; Human Reactions; Heating and Cooling Loads; Combustion and Consumption of Fuels; Systems and Equipment; Special Systems; Instruments and Codes. Section IV, for example, contains 5 chapters: Fuels and Combustion; Automatic Fuel Burning Equipment; Heating Boilers; Furnaces; Space Heaters; Chimneys and Draft Calculations; Estimating Fuel Consumption for Space Heating.

If You Need To Know

About heating load calculations there is a chapter covering this which includes heat loss coefficients, tables and formulas as well as data on edge loss from floor slabs. Likewise there is a chapter on cooling load calculations with design tables for solar heat gain through roofs, windows, glass block and figured rolled glass; also effects of shading devices. And if you need information on design methods for steam, water, vapor, vacuum, panel, warm air and air conditioning systems a chapter covers these topics as well as many others.

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS — HC

62 Worth Street, New York 13, N. Y.

Enclosed is $12.00 for standard edition of Heating Ventilating Air Conditioning GUIDE 1955. It is understood I may return it within 10 days if it is not satisfactory and my money will be refunded.

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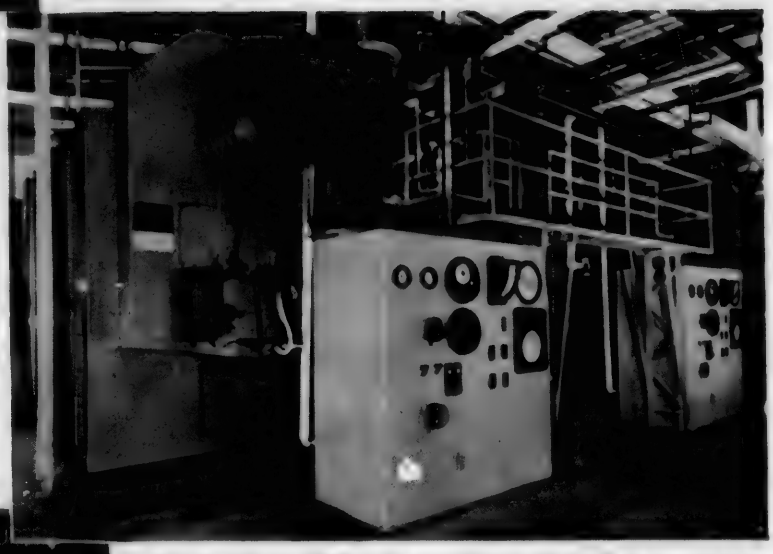
——Consulting Engineer ——Manufacturing Exec.
——Government Depts. ——Contractor ——Industrial
——Sales Engineer ——Operating ——Utility
——Other Classification

keeping steam cheap . . .



"Home" of the two, B&W Type FM Integral-Furnace Boilers is in the basement of the Service Building. Francisco & Jacobus, Engineer & Architect for the Service Center.

2 B&W FM Boilers Serve 5 Buildings at LONG ISLAND LIGHTING'S NEW SERVICE CENTER

With its residential load centered in an area where new home construction is booming, the Long Island Lighting Company has always anticipated load growth far in advance. The most recent example of this policy is the creation of the new service center in Hicksville, N. Y.

Covering 78 acres, the center includes a headquarters group of six buildings (providing 200,000 sq. ft. of floor space), huge storage facilities, parking space for almost a thousand cars, and even a helicopter landing strip. When three more planned buildings are completed, the center will contain about everything needed to operate the service end of a modern utility.

The steam requirements for all but one of the buildings is supplied by two B&W Type FM Boilers. Each unit is capable of generating 20,000 lb of steam per hr at 125 psi. Normally burning gas, the FM Boilers are equipped with combination burners and controls that permit changing over to oil in a matter of seconds and without substituting equipment. Automatic control, with on-off operation for low loads, is another important operational and economy feature of these versatile, self-contained boilers.

Satisfaction with the performance of B&W Integral-Furnace Boilers—both FMs and FFs—operating at other Long Island Lighting locations—was a strong factor in the choice of a dual-unit FM installation for the new service center. Along with other utilities and a broad range of industrial, commercial, and institutional users, Long Island Lighting has found the Type FM Boiler ideally suited to its needs. The strong acceptance of this unique boiler is indicated by the total steam capacity of more than 10,000,000 lb per hr of the units now in service or on order. It is available in standardized sizes for loads ranging between 2900 and 40,000 lb of steam per hr at pressures to 235 psi—may be obtained for higher pressures and with moderate superheat. *Write for Bulletin G-76A for the complete details of this unusual small boiler with an illustrated description of its cost-saving features. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.*

COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

BABCOCK & WILCOX

BOILER DIVISION

G-702

REFRIGERATION MOTOR CONTROLS that are Trouble Free

TYPICAL ALLEN-BRADLEY REFRIGERATION CONTROLS

Bulletin 709 Automatic Solenoid Starter

Temperature Control

Special Refrigeration Control Panel

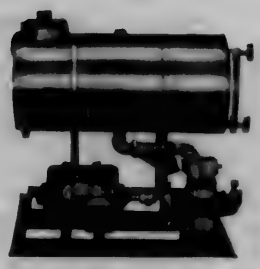
Why are Allen-Bradley automatic starters so popular for refrigeration and air-conditioning service?... Because they are so trouble free and dependable. Why are they trouble free? Because all A-B starters have only ONE moving part. No pivots, pins, or bearings to corrode or stick ... no jumpers to break. You install them . . . and forget them! No contact maintenance . . . Allen-Bradley cadmium silver alloy contacts never need cleaning, filing, or dressing. A time-saving and money-saving "plus value."

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and remain accurate "on the job" . . . even after years and years of service.

The Allen-Bradley trademark stands for "Quality" in motor control. Remember to specify Allen-Bradley—over the years you'll be money ahead!

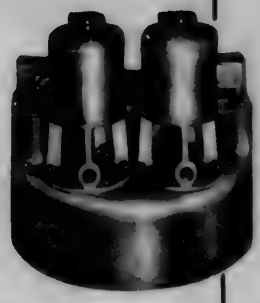
Allen-Bradley Co.
1330 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Limited, Galt, Ont.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY



"TM" TURBINE PUMP
Designed for boilers up to 250 hp and discharge pressures up to 150 lbs.

"UV" CONDENSATE PUMP
Capacities ranging from 2,000 to 40,000 sq. ft. EDR, and discharge pressures from 10 to 75 lbs.



"CV" VERTICAL PUMP
Heavy duty duplex unit with two float switches. Capacities ranging from 500 to 10,000 sq. ft. EDR and discharge pressures from 10 to 20 lbs.

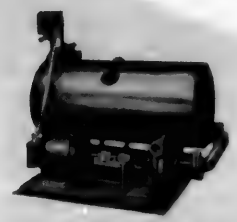
"CV" VERTICAL PUMP
Capacities ranging from 500 to 10,000 sq. ft. EDR and pressures from 10 to 20 lbs.

Skidmore Pumps

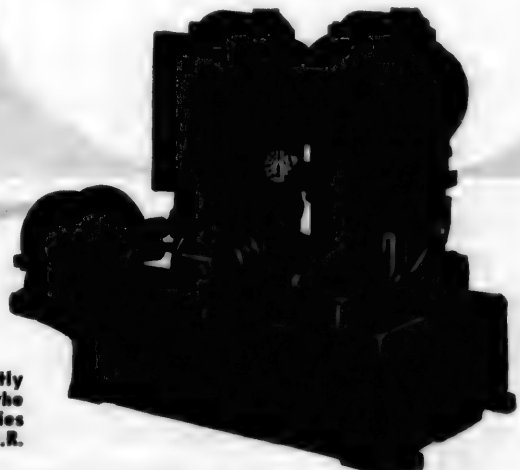
PEAK EFFICIENCY

. . . AT LOW COST!

Famous for their efficiency— means low installation cost, as well as low operating cost.



"HS" CONDENSATE PUMP
Capacities ranging from 1,000 to 65,000 sq. ft. EDR and discharge pressures from 10 to 75 lbs.



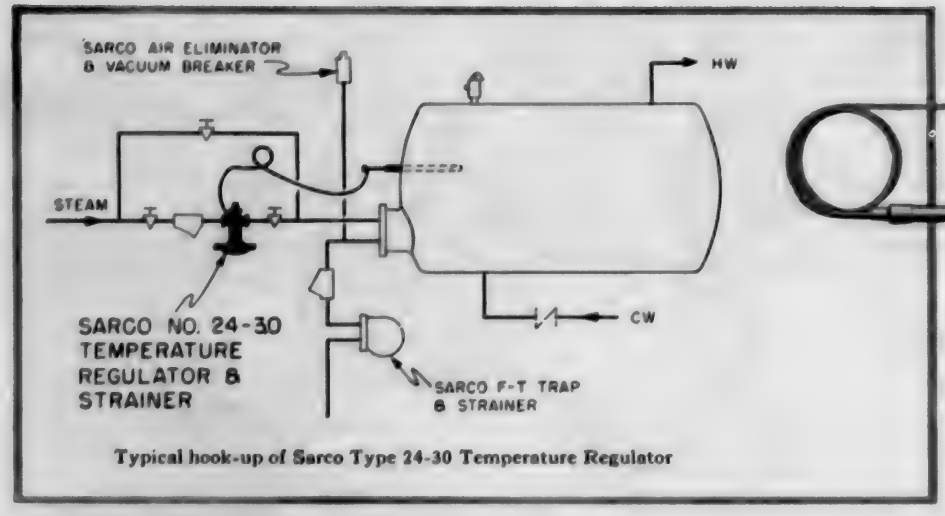
SKIDMORE VACUUM PUMP
Like all Skidmore Pumps it has constantly maintained the leadership throughout the years in capacity and efficiency. Capacities ranging from 5,000 to 100,000 sq. ft. E.D.R.

Write for bulletins or contact the nearest Skidmore representative for complete engineering data.

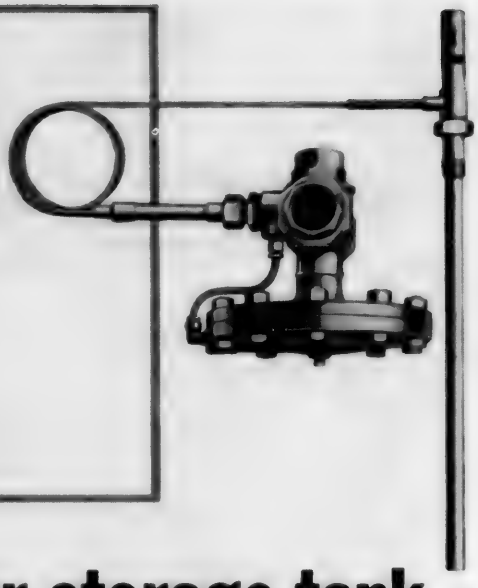
SKIDMORE IS SYNONYMOUS WITH QUALITY AND ENGINEERING LEADERSHIP SINCE 1921

SKIDMORE PUMPS

SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN



Typical hook-up of Sarco Type 24-30 Temperature Regulator



HOT WATER...in your storage tank

...when you want it...*and at minimum cost!*

That's the performance you get when this Sarco Temperature Regulator stands guard on your water heater.

With fuel representing about 50% of your total direct power costs, it's important that you *get hot water at lowest cost per wash.*

Here's how the Sarco 24-30 Temperature Regulator does the job:

NO OVERHEATING – during periods of no draw-off. The single seated valve shuts tight, prevents creeping of temperature.

LOW INSTALLATION COST – the T R 24-30 is self-contained and self-operated, no need to install compressed air or electric lines.

CLOSE TEMPERATURE CONTROL – thermostat actuates internal pilot valve which immediately opens or closes main valve.

LOW-MAINTENANCE PACKLESS SEALS – trouble-free design eliminates stuffing boxes, no repacking, no sticking or leakage of exposed valve stems.

WIDE RANGE OF ADJUSTMENT—you can adjust this temperature regulator 25° higher or lower than the temperature setting.

So, if you're not satisfied with your hot water service, call your local Sarco representative or write for Bulletin 600. Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.

Need Tempered Water ?

This Sarco Water Blender automatically mixes hot and cold water, delivers blended water at any desired temperature. Factory set for any temperature to 200° F., is easily adjusted to 15° F. lower and up to 40° F. higher than factory setting. Ask for Bulletin 800.

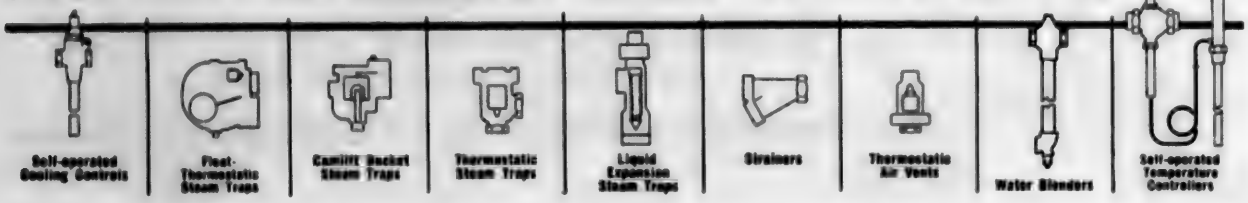
SARCO

SAVES STEAM

improves product quality and output

2046-B

STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES



NO LOSS of sales reported when Hess Brothers, Allentown, Pa., department store, installed this high pressure air conditioning system on its three upper floors. Linked with system already in use on lower floors, it points up the advantages of...

Kno-Draft High Pressure Air Diffusers

A neat solution to air conditioning a department store without disrupting sales was worked out by Carrier Corporation engineers for Hess Brothers, Allentown, Pa.

Key elements in the installation are Kno-Draft High Pressure Air Diffusers. These permit use of smaller than ordinary ducts, yet provide *draftless* air distribution and equalized temperature throughout the area. Built-in sound baffles assure quiet air delivery.

Installation was done in quarter sections on each floor simultaneously. Thus, only minimum rearrangement of selling space was necessary.

Dropped ceilings cover half the depth of ducts, giving them a shallow beam appearance. The Kno-Draft High Pressure Air Diffusers themselves are easily and quickly attached to the ducts.

Kno-Draft High Pressure Air Diffusion is one of the newest and most efficient methods of air conditioning. Connor engineers have prepared an authoritative 48-page textbook on the subject. Write on your letterhead for a copy of Bulletin K-33. Connor Engineering Corporation, Dept. J-45, Danbury, Connecticut.

CONNOR

kno·draft®

high pressure air diffusers

True Air Conditioned Comfort with multi-vent

LOW VELOCITY AIR DIFFUSERS

SPECIFIED FOR FORD...coast to coast

Modular Multi-Vent panels will provide a quiet, concealed, draft-free air distribution system in the four new FORD buildings listed at the right.

The Multi-Vent story is simple...this system distributes conditioned air at low velocity by gentle pressure displacement. This unique feature not only eliminates all draft complaints but also allows complete freedom in locating or relocating moveable partitions without repositioning the outlet panels.

In addition Multi-Vent can handle as many as 60 air changes per hour and still maintain an even, draftless, low rate of room air motion!

These are only a few of the many reasons why Multi-Vent is the choice of the nation's leading office buildings, hospitals, laboratories, factories, hotels and restaurants.

DEARBORN, MICHIGAN
Ford Central Staff Office Building (Illustrated above)
Architects and Engineers: Skidmore, Owings & Merrill, New York
Mechanical Engineers: Jaros, Baum & Bolles, New York
Contractor: Bryant & Detwiler, Detroit
Mechanical Contractor: Thermotank, Inc., Detroit

LOUISVILLE, KENTUCKY
Ford Assembly Plant Office Building
Albert Kahn Associated Architects and Engineers

MAHWAH, NEW JERSEY
Ford Assembly Plant Office Building
Giffels & Vallet, Inc.
L. Rossetti Associated Engineers and Architects

SAN JOSE, CALIFORNIA
Ford Assembly Plant Office Building
Architects and Engineers: F. A. Fairbrother & Geo. H. Miehls, Detroit
Consultants: Albert Kahn Associated Architects and Engineers, Detroit

Write today for new Multi-Vent Literature

DIVISION OF

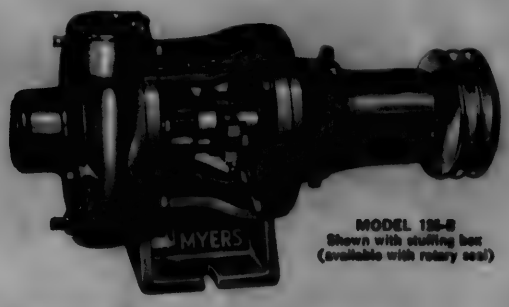
WHERE QUALITY IS TRADITIONAL

THE PYLE-NATIONAL COMPANY

1374 North Kostner Avenue, Chicago 51, Illinois

Sales and Engineering Representatives in Principal Cities of United States and Canada.

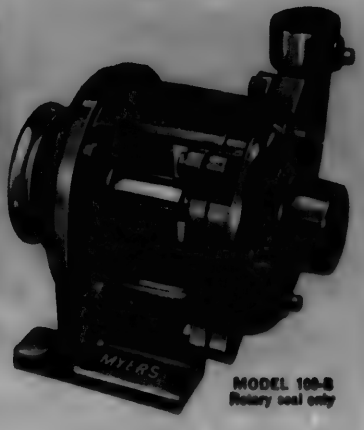
MODEL 125-M
Shown with stuffing box
(available with rotary seal)



MODEL 125-S
Shown with stuffing box
(available with rotary seal)

NOW... a complete line

of centrifugal pumps for air conditioning application from MYERS, the greatest name in domestic and farm pumps



MODEL 100-S
Rotary seal only

MODEL 100-M
Rotary seal only

FULL RANGE OF SIZES
⅓, ½, ¾, 1, 2, and 3 horsepower, motor-mounted or belt-driven models.

TWO CASING SIZES
1″ x 1¼″ or 1¼″ x 1½″.

ALL-BRONZE IMPELLER
Accurately balanced for smooth operation.

REMOVABLE BRONZE WEARING RINGS
Easily replaced for longer pump life.

ROTARY SEAL
Eliminates leakage (stuffing box may be specified on some models.)

CORROSION-RESISTANT SHAFT
Stainless steel for trouble-free service.

CAPACITOR-TYPE MOTORS WITH BUILT-IN OVERLOAD PROTECTION
Available in single or dual voltage for single or 3-phase current.

WIDE RANGE OF CAPACITIES AND HEADS
Models with capacities to 85 GPM and heads up to 135 feet.

Myers

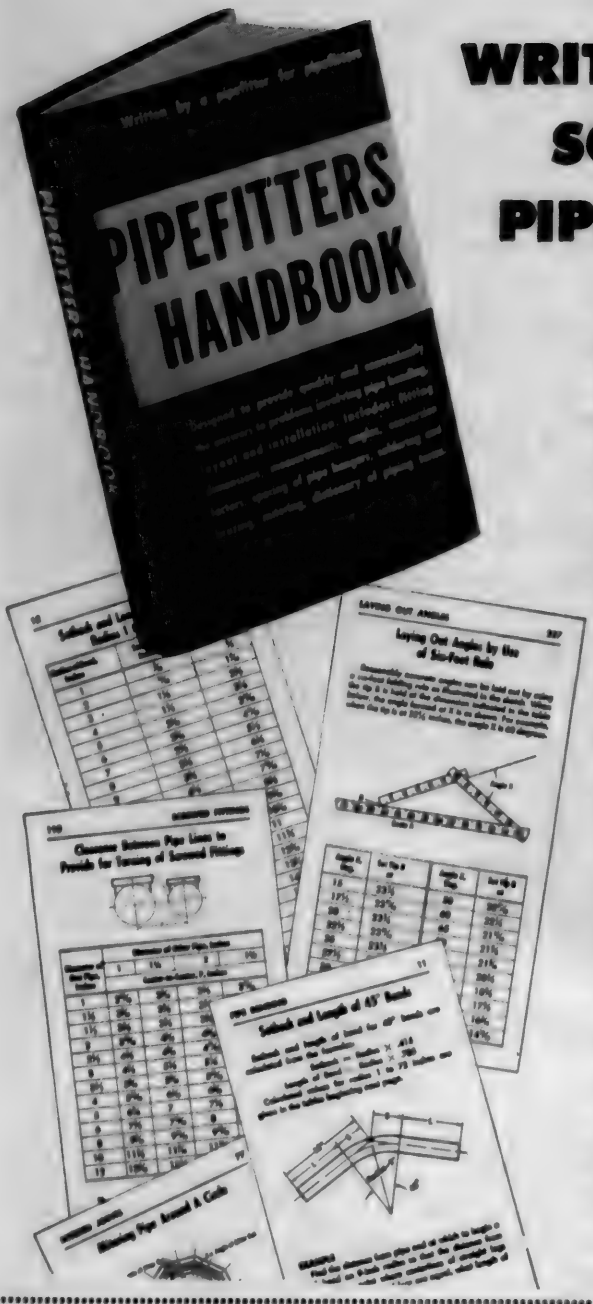
Write today *for performance curves and Bulletin M-787 on Myers Centri-Thrift Pumps.*

Myers

PUMPS WATER SYSTEMS AND WATER SOFTENERS

The F. E. Myers & Bro. Co. • Dept. HV-4, Ashland, Ohio

A HANDBOOK WRITTEN ESPECIALLY TO SOLVE AND SIMPLIFY PIPEFITTING PROBLEMS



PIPEFITTERS HANDBOOK is written especially to enable pipefitters quickly to solve problems met either in the shop or in the field in connection with pipe bending, mitering, layout, threading, etc. The author, Forrest R. Lindsey, is a union pipefitter with over 35 years' experience. A large part of the book is taken directly from original tables which he has developed over a long period of time as a result of his experience with practical problems. These tables eliminate the necessity for making lengthy calculations by giving immediate answers to all kinds of pipefitting problems. Typical pages shown at the left illustrate the intensely practical nature of the information in the PIPEFITTERS HANDBOOK. The actual size of the book is 4" x 7", and it is bound in flexible maroon Fabrikoid so that it will fit conveniently into a pocket. It is printed in large type on durable paper, so that smudging with soiled hands will not obliterate the characters.

Page After Page of Valuable, Practical Data!

PIPEFITTERS HANDBOOK provides information on all the following subjects: Pipe Bending—Offsets—Mitered Joints—Standard Pipe Dimensions and Thread Data—Screwed Fittings—Butt Welding Fittings—Flanged Fittings—Valves—Solder Joint Fittings—Other Pipe Data—Miscellaneous Data on sheet metal, properties of steam, melting points of metals, etc.—Mathematical Tables, Conversion Factors, Use of Trigonometry—Pipefitters Dictionary . . . a total of 282 time-saving, work-improving pages of information.

Examine this New Handbook Free!

No matter how much experience he has, every pipefitter will find the PIPEFITTERS HANDBOOK useful. It will repay many times its cost by speeding up and simplifying the solution of all kinds of everyday problems—and unusual ones, too! Just use the convenient coupon below to order copies of this new book for every member of your organization engaged in pipefitting.

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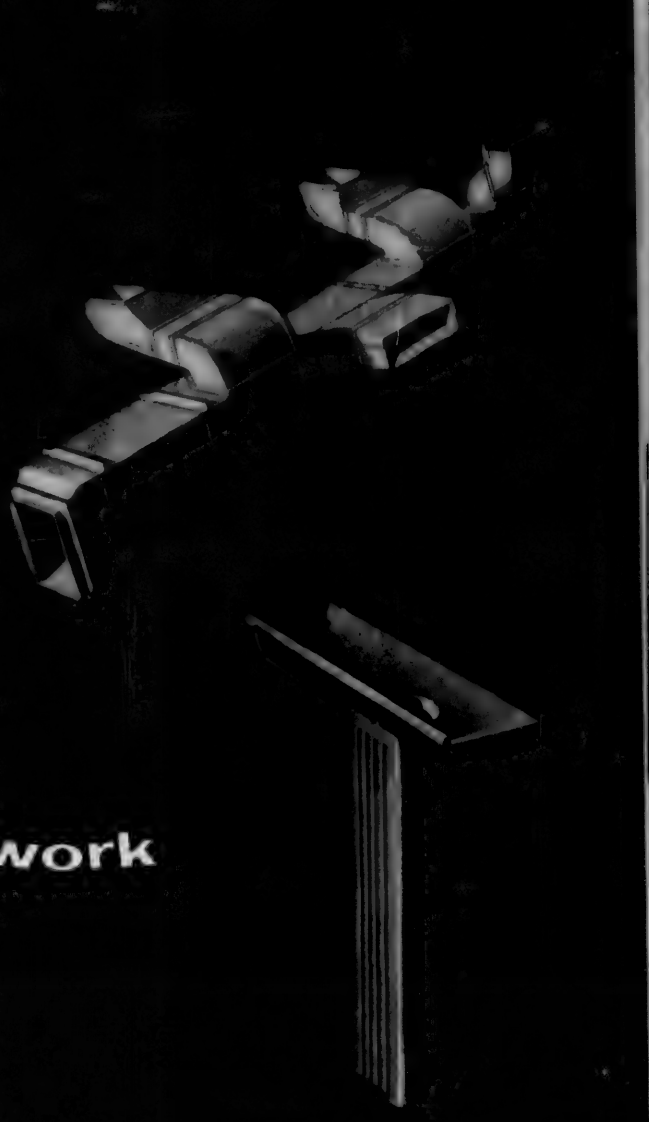
ACHV-4/55

There's built-in durability in

WEIRKOTE

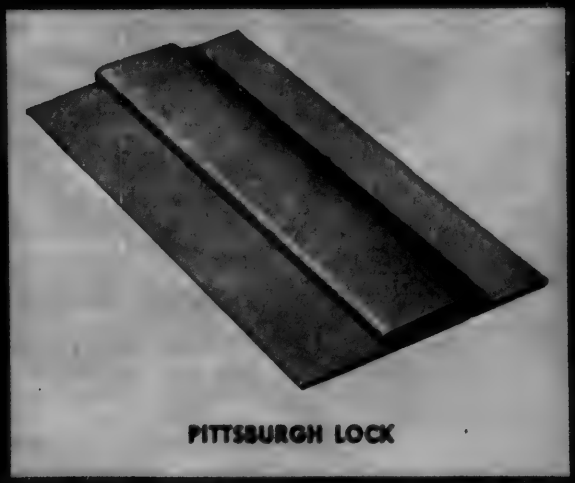
for all sheet-metal work



Wherever a durable zinc-coated material is needed for sheet metal fabrication, there's nothing better than Weirkote. Gutters, downspouts, ducts—no matter what the application, the name Weirkote on galvanized steel means uniformly high quality steel, tightly coated with zinc to resist cracking, peeling, flaking and corrosion. The high quality is assured by Weirton's modern mills and methods —and men.

When your specifications call for galvanized steel, call Weirton, and be sure.

Weirkote is available in coils and cut lengths: gauges 16 to 30 inclusive. Maximum width—42", maximum cut length—168". Weirkote can be obtained to fit any customer requirement. For standard roofing and siding it is guaranteed to conform to A.S.T.M. specification A361-52T.



PITTSBURGH LOCK

WEIRTON STEEL COMPANY

Weirton, West Virginia

NATIONAL STEEL CORPORATION

BARBER COLMAN

LINE-O-FLO ENGINEERED

Air Distribution

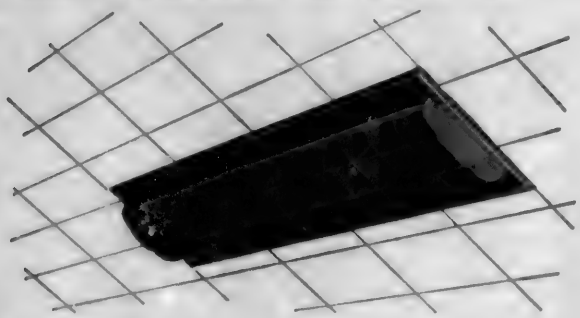
. . . accents architectural design of court house!

County fathers in Houston, Texas, took no chances when they were approving a $1,500,000 conditioned air system for the new $11,000,000 Harris County Court House. Barber-Colman equipment was specified throughout this modern structure, assuring finest possible end results from the sizable investment in conditioning apparatus. Air is distributed efficiently, quietly, unobtrusively, for heating, cooling, and ventilating from the Line-O-Flo and Venturi-Flo Ceiling Diffusers, and the Uni-Flo Sidewall Diffusers and Return Grilles. Not only are the results above par, but the air distribution units are easier to install, harmonize beautifully with the contemporary design, and last a lifetime with a minimum of service.

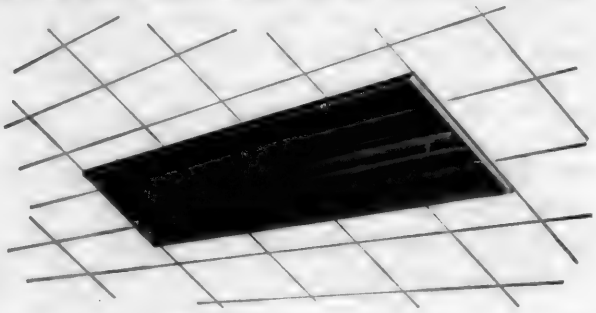
Architects: FINGER & RUSTAY. *Mechanical Engineer:* I. A. NAMAN. *General Contractor:* MANHATTAN CONSTRUCTION CO. *Mechanical Contractor:* CHARLES G. HEYNE AND COMPANY.

Eight-story court house, except for the jail area, is completely air conditioned. Four primary systems, located on the roof, heat, cool, ventilate, and control humidity as outside conditions require.

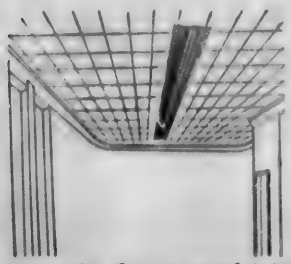
Line-O-Flo Ceiling Diffusers in lobby and court room areas quickly equalize temperature differential between supply and room air, preventing stratification and eliminating drafts. Combine readily with light fixtures.



Model LL Line-O-Flo is designed to receive a Day-Brite light unit, which is isolated from the air stream. Flange arrangements permit individual or continuous mounting.



Model LS Line-O-Flo, as used in Harris County Court House, provides positive control of air volume, plus uniform distribution over entire length. Individual or continuous mounting.



BLAZING THE TRAIL TO BETTER AIR DISTRIBUTION

***First* with widely accepted line-type air distribution**

Desire of architects and engineers for continuity of design in modern architecture led Barber-Colman Company into development of Line-O-Flo air distribution equipment. These were the first successful line-type outlets on the market. Scientifically designed, rolled steel members provide rigidity. Two models are available with flange arrangements for individual, or continuous strip installation. One Line-O-Flo model is designed to receive a fluorescent light unit. Both models are dimensionally co-ordinated for use with acoustical ceilings and other building products. Either may be used for supply (with balancing dampers) or return units. Reliable performance data is available on Line-O-Flo and all other Uni-Flo products. For literature, prices, and expert engineering help, phone our nearby Field Office, or write us.

Barber-Colman Company

Dept. P, 1102 Rock Street, ROCKFORD, ILLINOIS, U. S. A.

Field Offices in Principal Cities

Air Distribution Products • Automatic Controls • Industrial Instruments Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

quiet as a flame!

V-579
GAS VALVE

You'll have– **MORE SATISFIED CUSTOMERS . . . MORE PROFITS**

ACCEPTED BY ALL UTILITIES

with V-579 Gas Valves by DETROIT CONTROLS. No click, no hum, no noise because the V-579 is operated by positive opening, positive closing "Biflex" motor!

Install these V-579 gas valves close to living rooms or sleeping rooms, secure in the knowledge that they will operate dependably and *quietly*. Their operation is independent of gas pressure and gravity. Ideal for *all* types of gas, in any domestic heating unit! ½ inch to 1¼ inch sizes.

Talk to your Detroit Controls Wholesaler *Today* . . . or write for Bulletin 229.

DETROIT CONTROLS CORP. manufactures a complete line for the air conditioning and refrigeration industries as well as heating.

DETROIT CONTROLS CORPORATION
6000 TRUMBULL AVE. • DETROIT 8, MICHIGAN
Division of AMERICAN RADIATOR & STANDARD SANITARY Corporation

Representatives in Principal Cities • Canadian Representatives: RAILWAY AND ENGINEERING SPECIALTIES, LTD., Montreal, Toronto, Winnipeg.

AUTOMATIC CONTROLS for REFRIGERATION
AIR CONDITIONING • DOMESTIC HEATING • AVIATION • TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES
Serving home and industry
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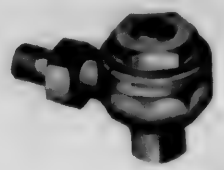
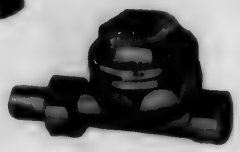
What a big difference a trap can make!



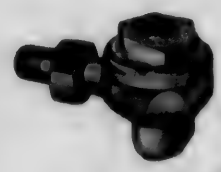
Angle



Straightway

Vertical

Left hand corner



Right hand corner

Marsh Packless Radiator Valves are perfect team mates for Marsh Radiator Traps. The metal-to-metal seal places them in a class all their own.

Yes, the success or failure of a steam distribution system can hinge on things as small as radiator traps. That's why it pays to use Marsh Radiator Traps—traps that are individually and permanently adjusted to close tight on steam, but open promptly and pass air or condensate at temperatures only a few degrees below closing temperature.

The part that provides positive operation in Marsh Radiator Traps is that rugged-but-sensitive thermostatic diaphragm. After this element has been assembled it is made completely seamless by a heavy overall deposit of copper. It is then filled with an accurately measured charge of volatile fluid; finally tested by expert operators to make sure that its expansion and contraction is exactly right to produce the utmost efficiency and economy.

Construction throughout is in keeping with the effective diaphragm. Bodies are of extra heavy cast brass suitable for pressures up to 125 lbs. steam. Bonnet assemblies of a given type and size are interchangeable. Trap seats are renewable. All components are made with a large safety factor beyond rated operating pressures.

Next time make it Marsh throughout and see the difference—. . . Marsh traps, packless valves, bucket traps, venting valves. All are covered in the new fact-filled catalog.

MARSH HEATING EQUIPMENT CO.

Sales affiliate of Jas. P. Marsh Corporation

Dept. U, Skokie, Illinois

MARSH

Heating Specialties **SINCE 1865**

STAINLESS STEEL

...fights corrosion...solves many piping problems

● Stainless steel piping, using TUBE-TURN* Stainless Steel Welding Fittings, can provide long, safe service where corrosive gases or fluids are handled. Likewise, stainless steel systems are superior where temperature extremes are encountered, for handling dangerous materials safely, for preventing contamination.

Tube Turns offers a *complete line* of Stainless Steel Welding Fittings in three analyses: AISI Type 304, Type 347, and Type 316; and in four schedules: 5S and 10S (thin wall), and 40S and 80S (heavy wall). For the *right* stainless steel welding fittings, and for help in proper application, get in touch with your Tube Turns' Distributor. You'll find one in every principal city.

TUBE-TURN Welding Fittings and Flanges are made in U.S.A.
They meet all U.S. piping code specifications

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Detroit • Chicago • Denver • Los Angeles
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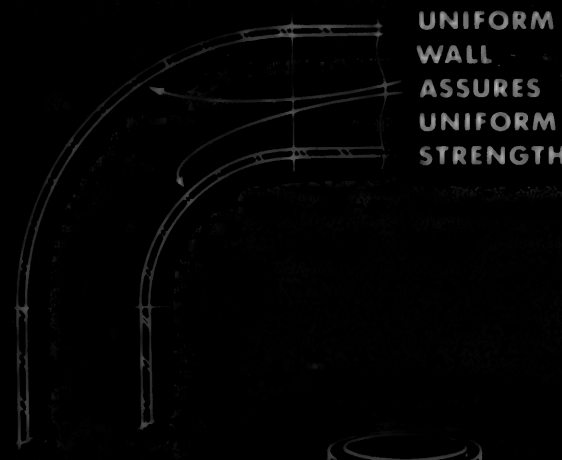
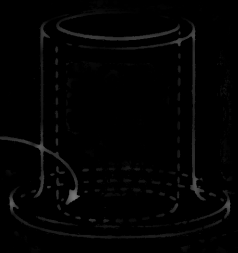
*"tt" and "TUBE-TURN" Reg. U.S. Pat. Off.

How you get *extra service* from TUBE-TURN* Stainless Steel Welding Fittings

EXTRA-VALUE FEATURES AT NO EXTRA COST



MATCHES PIPE
BURSTING STRENGTH



NO CORROSION
POCKETS

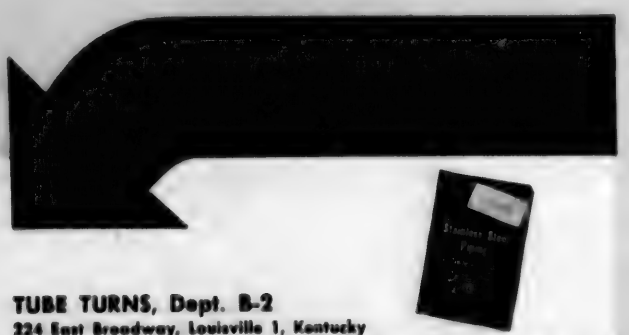
CHECK THESE FEATURES
Only TUBE TURNS offers them all

- Fittings meet standard chemistry specifications
- Minimum wall thickness of elbows 87½% of nominal
- Fittings meet minimum calculated bursting pressure of matching pipe
- Qualified welders and procedures used where welding is required
- Each fitting properly solution heat treated
- Each fitting passivated
- Other special grades of stainless steel, and all other alloys available

All these extra value features available to you at no extra cost.

MEET ALL CODES

TUBE-TURN Stainless Steel Welding Fittings meet all specifications: ASTM A312 (for material); MSS SP43 and ASA B16.9 (for dimensions); and MSS SP25 (marking procedure).



TUBE TURNS, Dept. B-2
224 East Broadway, Louisville 1, Kentucky
Please send STAINLESS STEEL "WHY AND WHERE" book.

Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____

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New York	Los Angeles
Philadelphia	San Francisco
Pittsburgh	Seattle
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Denver	Dallas

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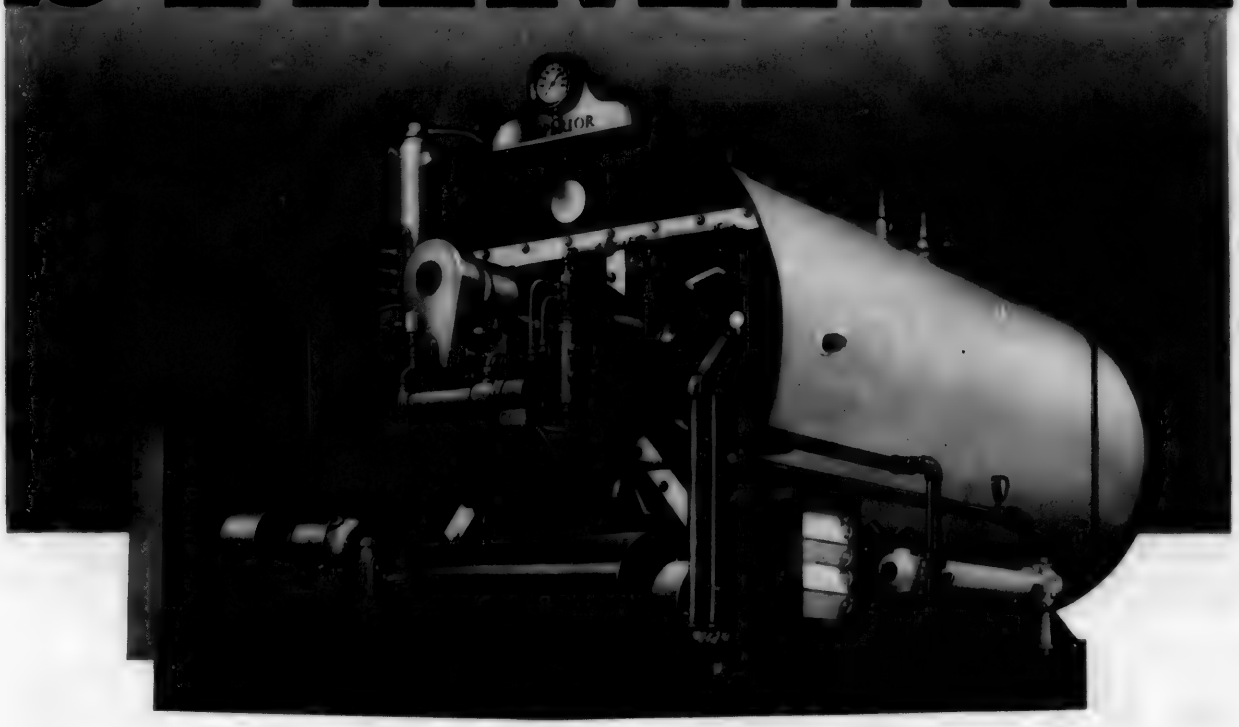
TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

STAMINA



for YEARS of low cost steam

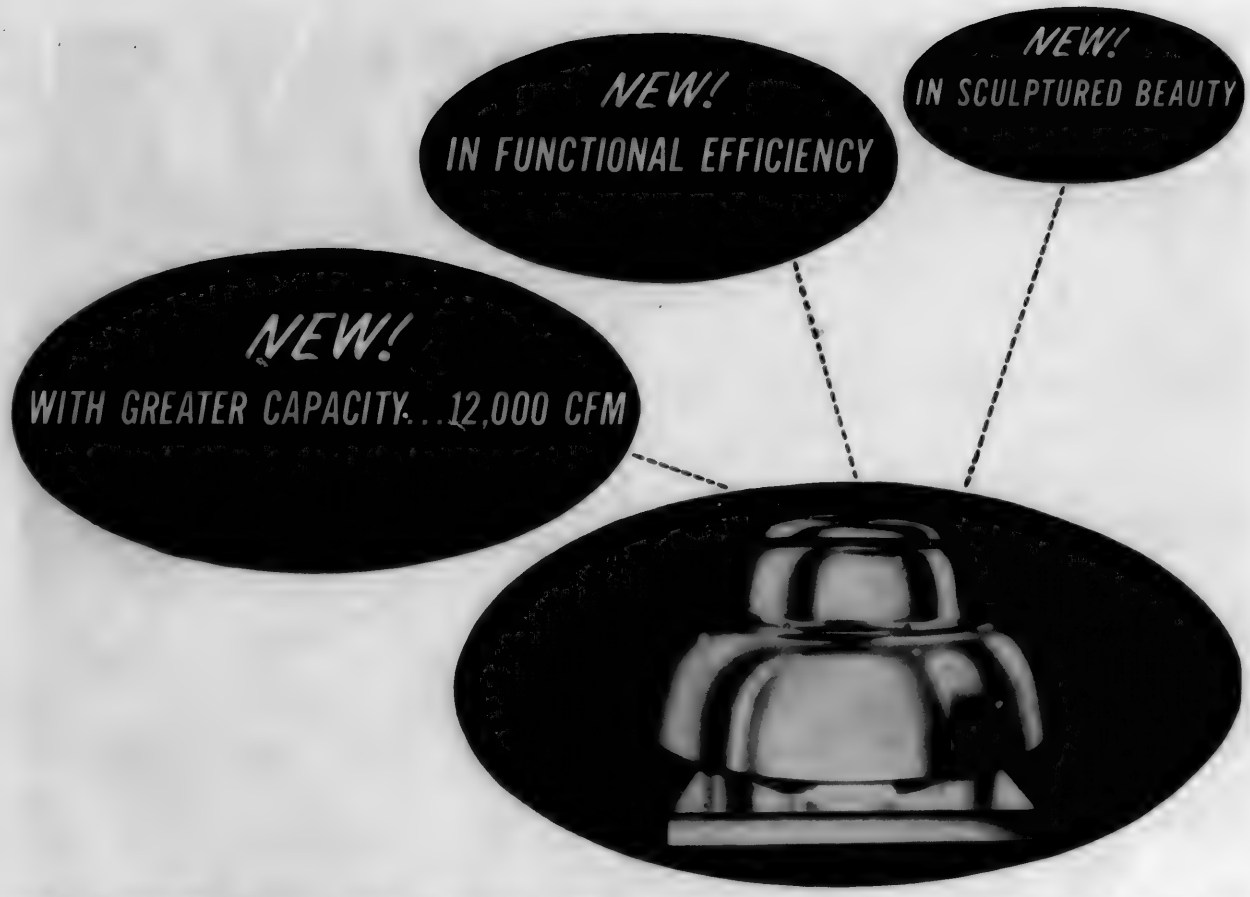
Get the complete story. Write for Catalog 719 describing 18 sizes from 20 to 600 b.h.p; pressure to 250 p.s.i. burning oil or gas or both.

Boilers, too, grow old . . . and when the honeymoon of the first year or two is over, dirt, scale, and wear on moving parts start to take their toll in loss of efficiency. That's why Superior Steam Generators are built bigger, heavier, and more rugged, with four-pass construction and full 5 sq. feet of heating surface per boiler horsepower, measured on the smaller I.D. of the tubes. The relatively slow speed full bank induced draft fans, the larger triple-blow-down water column, and the rigid channel iron base are other typical features of design which add the stamina that makes efficient low cost steaming a reality . . . not for a year or two; but throughout the long life of the unit.

for performance you can **BANK** *on*

SUPERIOR
STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.



The NEW Jenn-Air BELT-DRIVE Centrifugal Roof Exhauster

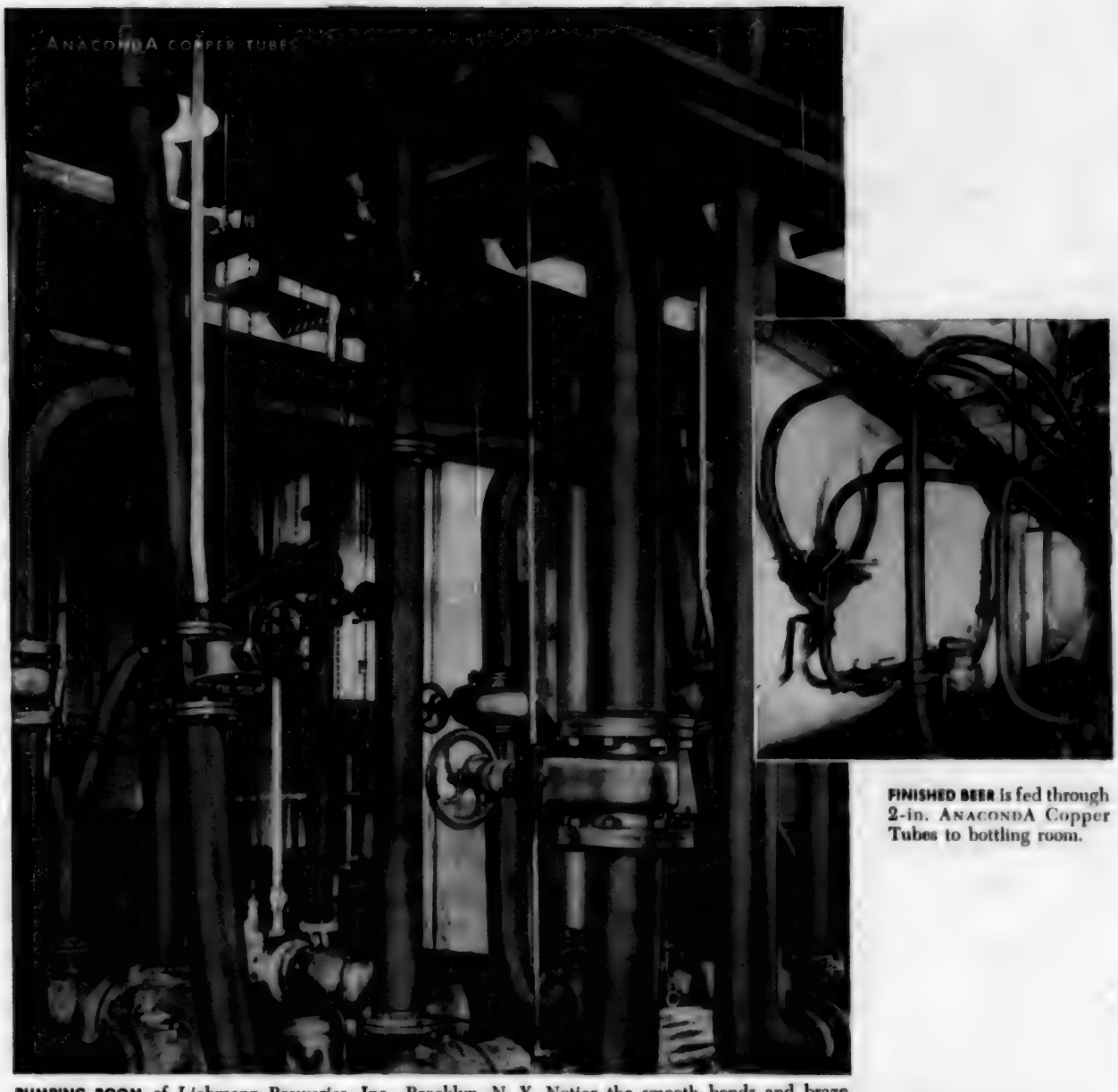
Again leading the way, Jenn-Air provides a new innovation in spun all-aluminum belt-driven exhausters. With capacities up to 12,000 CFM, Jenn-Air becomes the first to offer these higher capacity belt driven exhausters with the same attractive low contour Jenn-Air designing. With Jenn-Air Belt-Drive Roof Exhausters, it is no longer necessary to use the unsightly industrial type ventilators to provide for those higher capacity requirements. *Certified ratings in accordance with NAFM and ASH&VE code tests by independent laboratory.*

Look at these 7 ways Jenn-Air Exhausters excel:

1. Easy Installation—constructed from heaviest gauges of corrosion resistant aluminum, yet light enough for easy assembly on the roof;
2. Lower Fire Hazard—spark-proof blade—motor mounted out of air stream away from inflammable air contaminations;
3. Beauty—design that blends with today's modernistic buildings;
4. Ageless Aluminum Rustproof Construction—will outlast any structure—no painting required;
5. Quiet! full ball-bearing grease packed motor means dependable trouble-free operation;
6. Low Contour—hugs the roof for pleasing appearance . . . eliminating unsightly intrusion with roof line;
7. Package Unit—nothing else to buy . . . ready to install.

Jenn-Air also offers wall exhausters which can be installed close to the area needing ventilation, thus reducing duct work. Only Jenn-Air offers dual ventilation . . . both roof and wall exhausters.

JENN-AIR PRODUCTS COMPANY, INC.
Architects & Builders Building
Indianapolis 4, Indiana



FINISHED BEER is fed through 2-in. ANACONDA Copper Tubes to bottling room.

PUMPING ROOM of Liebmann Breweries, Inc., Brooklyn, N. Y. Notice the smooth bends and braze into main line (at top of picture). These are the kinds of savings you get with ANACONDA Copper Tubes.

VERSATILE COPPER:

Efficient, economical piping for brewers of Rheingold Beer

In the pictures above you'll find numerous reasons why ANACONDA *Copper Tube* pipelines are *economy* pipelines. They adapt easily to any plant layout and equipment. Long lengths of lightweight ANACONDA Copper Tubes speed assembly, too. They may be bent so you can clear beams, girders and other obstructions—without extra joints and fittings. And fewer fittings mean less flow resistance, lower pumping costs. ANACONDA Copper Tubes with solder-type fittings also permit you to make sound, economical connections. You can also dismantle and reassemble *copper* tube lines easily to meet changing plant conditions.

ANACONDA Copper Tubes are strong, rustproof and corrosion-resistant. They remain smooth and clean inside.

For reliable service on ANACONDA Copper and Copper Alloys—consult your Anaconda Distributor.

Write for free booklet, "ANACONDA Copper Tubes for Industrial Applications" to *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

ANACONDA®

Makers of copper tubes for industrial processing, water, heating, soil, waste and vent lines; welding rods; flexible metal hose and tubing; heat exchanger tubes; bus conductors; sheet copper; refrigeration products.

Need help
on your
Air Conditioning
problem?

The Bettmann Archive

This 16th century woodcut shows a "one manpower" air conditioning unit. From the size of that bellows, it looks as if this fellow could use some help. If you need assistance on air conditioning problems for your clients, let Airtemp help you.

Just call on AIRTEMP

Airtemp offers the help you need in planning commercial and industrial air conditioning

Get Help from Top Engineers
Through Airtemp Construction Corporation, a subsidiary of Chrysler Corporation, we offer architects, engineers and contractors the advisory service of engineering specialists—pioneers in commercial and industrial air conditioning.

Get the System You Need
Airtemp manufactures a complete range of precision-built equipment for *every* type of modern air conditioning system—conventional or specially engineered, for a room or a building.

You Can Specify with Confidence
Everyone knows and trusts the Chrysler name. You can't go wrong on specifying a name your clients trust.

You're Sure of Good Service
You'll always be assured of dependable local service—thanks to Airtemp's nationwide network of personnel and facilities.

And the Cost Will Please You
Both installation cost and operating costs are surprisingly low due to Airtemp's famous design and efficiency.

IT'S AIRTEMP—FROM COAST TO COAST!

Union Pacific Building, Omaha, Nebr. Architect: Davis Hunt, Chicago; Engineers: Ritter & Mott, Chicago; Contractors: James Stewart & Company.

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Chrysler Building East, New York, N. Y. Architects: Reinhard Hofmeister & Walquist; Consulting Engineers (Structural) Edwards & Hjorth; Consulting Engineers (Mechanical and Electrical): Guy B. Panero.

WRITE FOR DETAILS
You can get complete information on this Airtemp service simply by writing to: Airtemp Division, Chrysler Corporation, Dept. ACHV-4-55, Dayton 1, Ohio.

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DIVISION OF CHRYSLER

AIRTEMP
Comfort Zone

AIR CONDITIONING • HEATING FOR HOMES, BUSINESS, AND INDUSTRY

LOWEST COST PER POUND OF STEAM

STARTS WITH FEATURES LIKE THESE

OPERATING ENGINEER:
"Ease of maintenance at less cost in time and materials — more dependable year-round operation."
INSURANCE INSPECTOR:
"All-welded construction — approved electronic operating and safety devices . . . meet ASME and Underwriters Laboratories codes."
PLANT SUPERINTENDENT:
"Steam when you need it and in the quantity you require."
CONSULTING ENGINEER:
"Exclusive boiler-burner design gives you highest efficiency even with fluctuating loads, down to 30% of rating."
ARCHITECT:
"Compact, space saving design simplifies boiler room planning for single or multiple units."
OWNER:
"Uses oil or gas fuels which are easier to handle, more efficient and lower in operating cost."
CONTRACTOR:
"Boilers shipped ready to install — can be in operation in as little as 24 hours after delivery."
BOILER INSPECTION ENGINEER:
"A large low-furnace design provides greater safety."
"It's NEW — Get The Facts On The CB Boiler — Write Today"

that's why you profit most from Cleaver-Brooks self-contained boilers

• Top to bottom, inside and out, you get more money-saving features when you specify or buy Cleaver-Brooks self-contained boilers. You make an *investment in quality* that pays off in lowest net cost per pound of steam for processing or heating.

YOU BENEFIT from more than 20 years of experience, working closely with men who have made it their business to be *right* about boilers. You profit from complete coordination throughout planning, installing, supervising and final operation.

YOU BENEFIT from self-contained design and original four-pass construction. These Cleaver-Brooks engineered "firsts," plus forced draft, 5 sq. ft. of heating surface per boiler hp, and exclusive burners, all contribute to highest heat transfer. Guaranteed 80% thermal efficiency when firing with oil is the direct result!

Whether you're planning a new steam plant or modernizing, make certain you get the complete Cleaver-Brooks story before you buy. See your Cleaver-Brooks representative or write for catalog AD-100. Cleaver-Brooks Company, Dept. D, 315 E. Keefe Ave., Milwaukee 12, Wisconsin, U.S.A. *Cable Address CLEBRO — Milwaukee — All Codes.*

One typical owner can count on yearly savings ($15,000 fuel and $10,000 labor) from this battery of three 150 hp Cleaver-Brooks self-contained boilers.

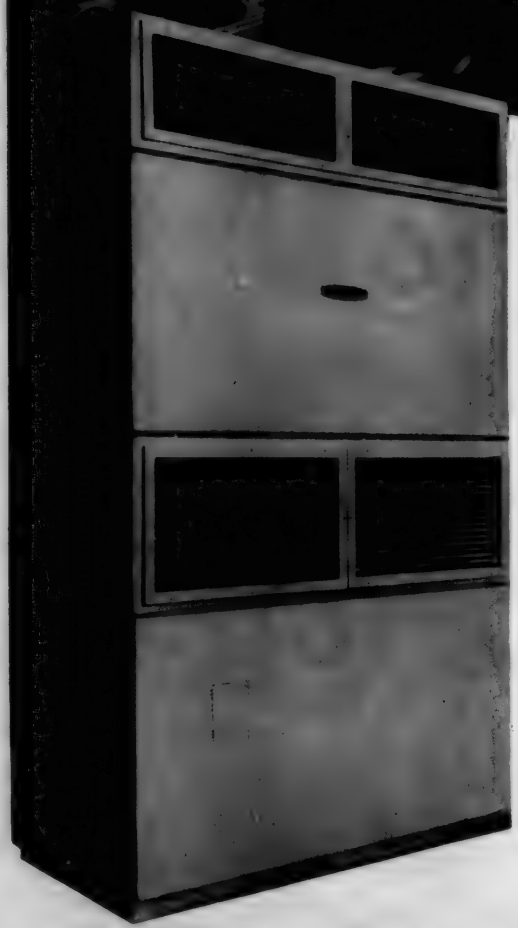
•

NOW — FIRST SIZES OF THE CB BOILER ARE MADE IN CANADA, TOO.

•

Cleaver Brooks

ORIGINATORS OF THE SELF-CONTAINED BOILER



Frick Unit Conditioners are built in 3, 5 and 7½ horsepower sizes. The largest is illustrated. Finish is a beautiful Hammermatic mottled blue-grey.

FRICK

Unit Air Conditioners

Serve this busy store, as well as restaurants, hotels, offices, factories and many other businesses, everywhere. Note how neatly the conditioner was adapted to the layout of the store through ductwork: this is typical of the complete engineering service you get with Frick equipment.

Frick air conditioners have many advantages . . . larger cooling surfaces . . . insulated condensers . . . self-cleaning filters . . .heavier,quieter construction . . . three sizes . . . backed by over 70 years' refrigeration experience.

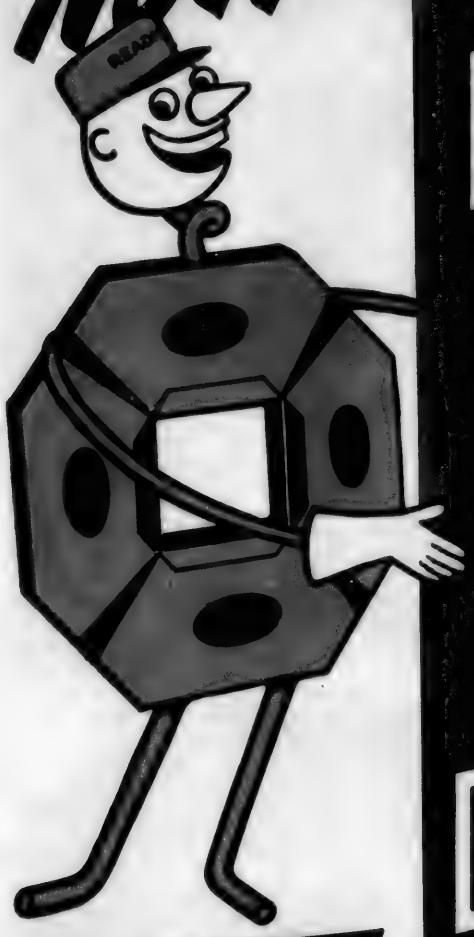
Get full details on other important features from Frick Bulletin 522. Some good territories open for qualified distributors. Write, wire, phone or visit

DEPENDABLE REFRIGERATION SINCE 1883

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

NOW-M... di... offers:



READING COPPER TUBE for DRAINAGE SYSTEMS

- Assures Top Quality Installation that can cost less than ordinary installation!
- Effects Solid Savings in installation time and costs!
- Reduces Carpentry Work by pre-assembly done in shop or on the job!

Mr. Readi-Pakt Also Recommends:

- √ READING "LEKTRONEAL" COPPER WATER TUBE
- √ READING RED BRASS AND COPPER PIPE
- √ READING "LEKTROSEAL" COPPER REFRIGERATION TUBE

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READING COPPER TUBE

Get Allis-Chalmers Engineering help on PUMPS

It pays to rely on Allis-Chalmers for your air conditioning pump needs. Your Allis-Chalmers representative or distributor is an experienced, highly qualified specialist who will help you pre-engineer the setup — help you get the simplest possible layout that will be most effective.

Get Immediate Delivery From Stock

Allis-Chalmers air conditioning pumps, in a complete range of types and sizes, are carried in stock by Regional Warehouses and Authorized Distributors throughout the country. Your representative will show you how to expedite pump selection and ordering. Contact him before you start your next job. A-4623

Milwaukee 1, Wisconsin

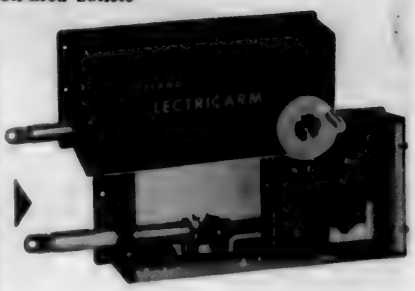
ALLIS-CHALMERS

CLEVELAND CONTROLS

MILLIONS

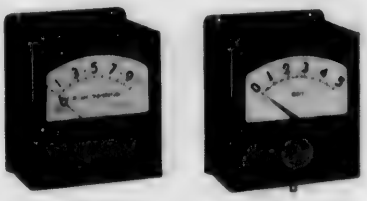
Below are described the Cleveland combustion instruments and controls that save users millions of dollars every year through—less fuel consumption—lower cost operation—less maintenance, and greater efficiency. Controls are available to provide these savings on coal, gas or oil-fired boilers —natural or induced draft.

Automatic Damper Control—Maintains a constant rate of draft for greater efficiency from all fuels. Fully electric —sequencing or non-sequencing models available. Starting Draft Selector and "Lo-Draft" Cut-Off features for induced draft installation are optional.

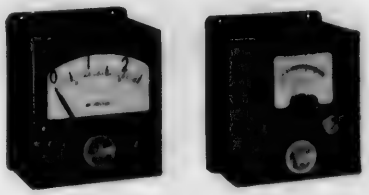


"Lectricarm" Drive Unit—Powerful, reversible, all electric, remote controlled drive unit. Responds to impulse from damper control and steam control. Operates with great accuracy without hunting or over-running.

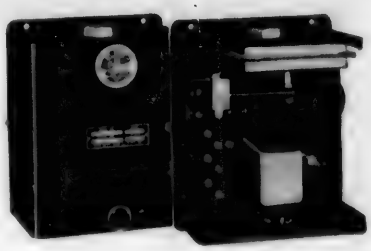
Steam Control—Compact master regulator, for accurate, automatic regulation of steam pressure from stoker, gas or oil-fired boilers. Highly sensitive—holds pressure to + or − 1% of required setting. Saves fuel by preventing "over-firing", controlling fuel and air, eliminating "stop and start" firing.



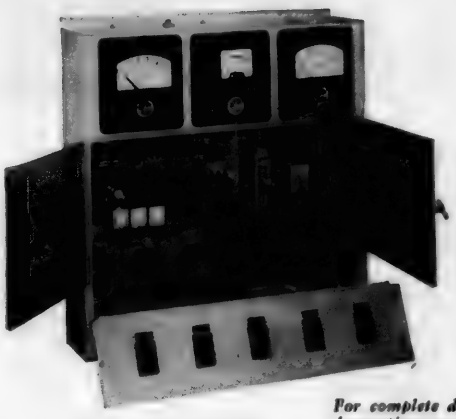
Cleveland Gages for indicating draft, air pressure, flue gas temperature and smoke conditions are essential to maximum boiler operating efficiency. The engineer who knows these conditions can operate the boiler plant with minimum loss. Complete line of gages includes single and multi-pointer units with wide selection of scales.



"Lo-Draft" Cut-Off Control—Safety device engineered to prevent explosion or damage to boiler by automatically cutting off burner when draft fails. Time delay prevents nuisance shutdowns due to momentary low draft. Provides positive, fail-safe protection by sampling draft in combustion chamber or at breeching. Signal light gives visual warning of momentary or sustained draft failure.



Control Panel Board Cabinets—Factory assembled, packaged control cabinets group all primary burner controls, flame safeguards, gages, fuses, circuit breakers, etc., in one neat, compact cabinet. Constructed of heavy gauge steel, it accommodates damper control and other required CFE units, plus additional equipment specified or furnished. Size of cabinet 34" x 34" x 8".



For complete detailed information on these and other combustion instruments and controls fill in and mail attached coupon.

COMBUSTION INSTRUMENTS & CONTROLS FOR EFFICIENCY AND ECONOMY

CLEVELAND FUEL EQUIPMENT COMPANY

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CLEVELAND FUEL EQUIPMENT COMPANY • 1111 Brookpark Road, Cleveland 9, Ohio

Gentlemen: Please send me detailed information on:

- ☐ Damper Controls
- ☐ "Lectricarm"
- ☐ Steam Controls
- ☐ Gages
- ☐ "Lo-Draft" Cut-Off
- ☐ Control Cabinets

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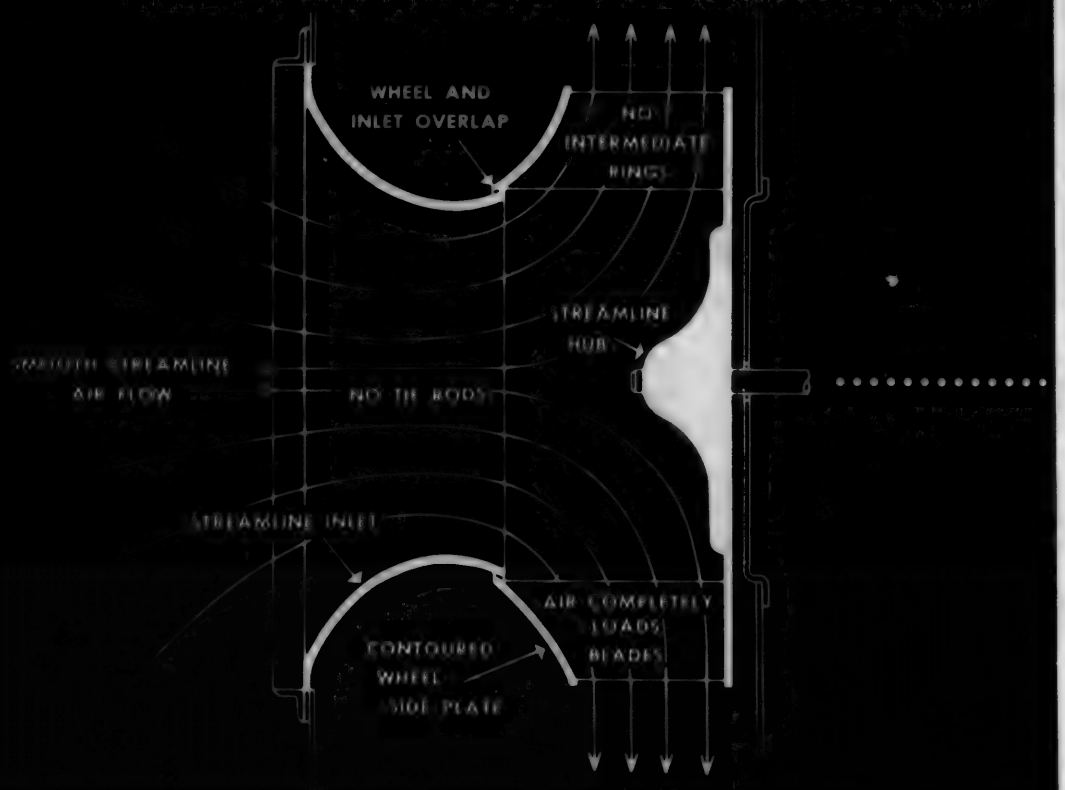
Fact:

Westinghouse Aerodynamic Fan Line More Efficient,



MECHANICAL EFFICIENCY 86%...
STATIC EFFICIENCY OVER 80%

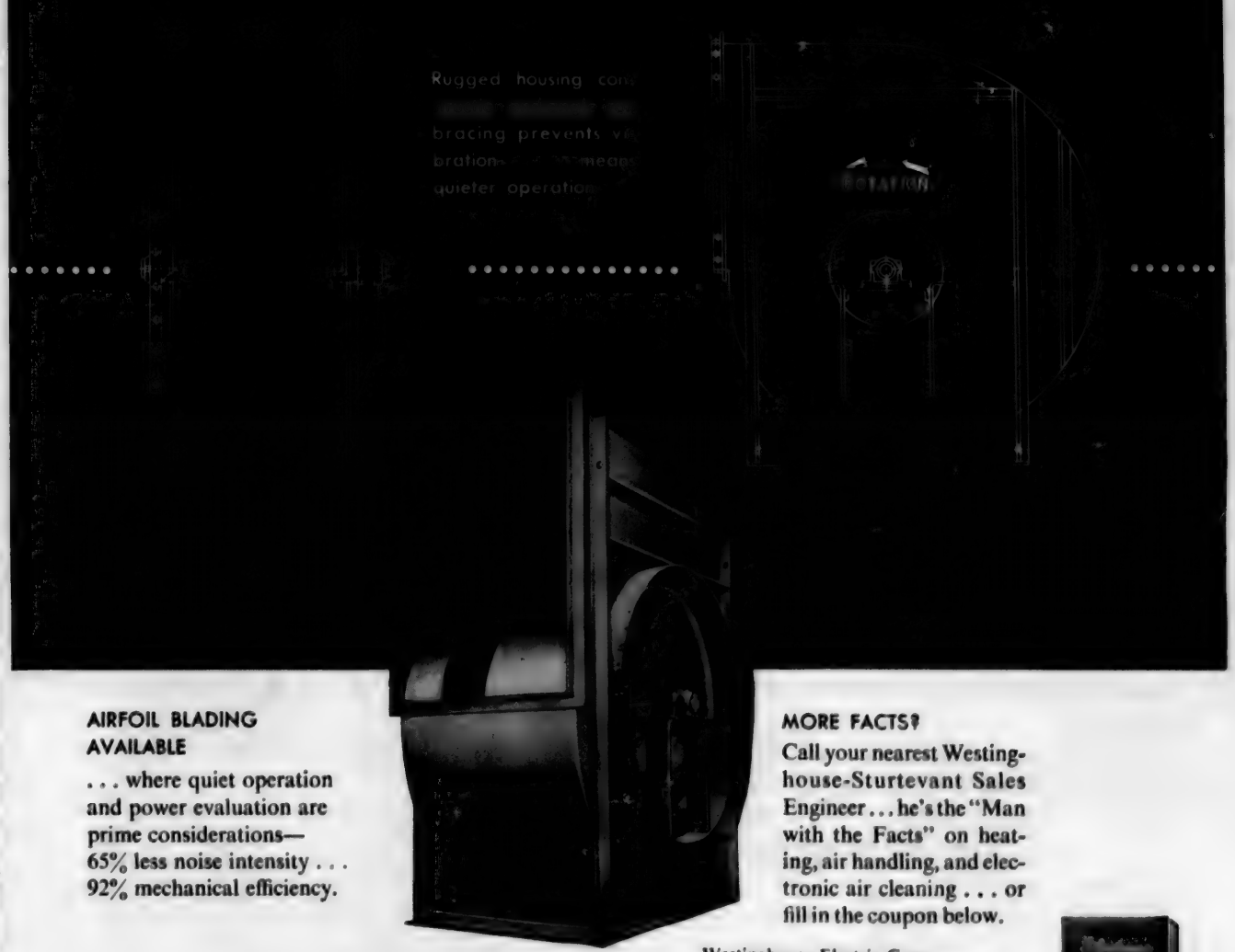
With unobstructed airflow through the wheel in all sizes, the "Silentvane" fan line also offers these other practical advantages:

1. **True self-limiting horsepower characteristic**
2. **Peak horsepower developed in normal selection range**
3. **Quiet, stable operation**
4. **Sharply rising pressure characteristic throughout normal performance range**

WIDE RANGE OF APPLICATION

Handling from 600 to 500,000 cfm, the performance-proved Westinghouse "Silentvane" fan line provides an almost unlimited choice of air moving equipment. Coupled with Westinghouse-Sturtevant power-saving Vane Control, "Silentvane" fans offer precise control of air volume at optimum efficiencies. In smaller sizes, 36" and under, fan arrangements are convertible.

Research Makes "Silentvane" Quiet, Non-Overloading



AIRFOIL BLADING AVAILABLE

. . . where quiet operation and power evaluation are prime considerations—65% less noise intensity . . . 92% mechanical efficiency.

MORE FACTS?

Call your nearest Westinghouse-Sturtevant Sales Engineer . . . he's the "Man with the Facts" on heating, air handling, and electronic air cleaning . . . or fill in the coupon below.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE . . . IF IT'S Westinghouse

J-80437

Westinghouse Electric Corp.
Sturtevant Division, Dept. 6C
Hyde Park, Boston 6, Mass.

I'm interested in your new booklet. Send me a copy right away.

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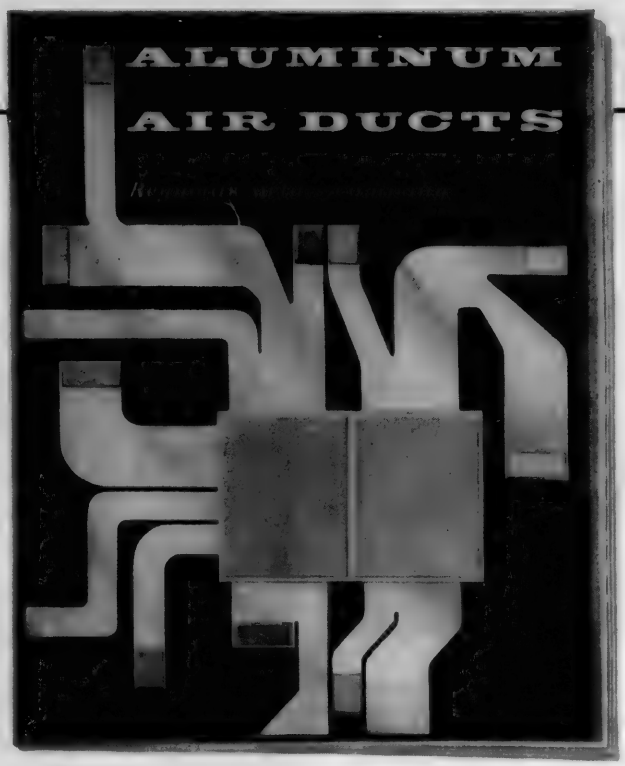
AIR CONDITIONING MAKES THIS NEW BOOK EVEN MORE IMPORTANT–



Aluminum ducts have advantages even in the simplest warm-air heating system. Its emissivity is lowest of any practical duct metal–approximately 5% compared to 25% for galvanized. And its smoother surface speeds air flow.

Its outstanding advantage, however, is freedom from rust. *And with today's air conditioning this quality becomes all-important.* Problems of moisture condensation–and danger of rust–are inevitable when ducts are used for air cooling as well as heating.

An authoritative Application and Data Handbook on Aluminum Ducts is therefore more necessary today than ever before. The manual illustrated has just been published by Reynolds.

Experts of air conditioning equipment companies have cooperated with Reynolds engineers in its preparation. You are cordially invited to use it.

PLEASE WRITE FOR YOUR COPY ON YOUR COMPANY LETTERHEAD. REYNOLDS METALS COMPANY, GENERAL SALES OFFICE, LOUISVILLE 1, KENTUCKY

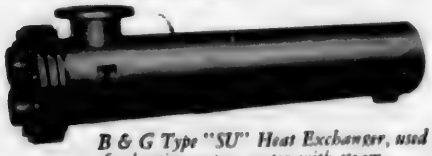
REYNOLDS ALUMINUM

See "MR. PEEPERS," starring Wally Cox, Sundays, NBC-TV Network

THEY WANTED *QUIET* OPERATION!

Installation of B & G Universal Pumps for circulating heating and cooling circuits.

Circulation from chiller to cooling tower is handled by B & G Universal Pumps.



B & G Type "SU" Heat Exchanger, used for heating system water with steam.

NEW ROTARY INTERNATIONAL BUILDING SELECTS *B & G UNIVERSAL PUMPS* AND *HEAT EXCHANGERS* FOR HEATING AND COOLING SYSTEM

The advantages of mechanically circulated water for both heating and cooling are well illustrated in this installation.

To assure *quiet* operation, B & G Universal Pumps are used to circulate all water, including that in the chiller and cooling tower circuits. The same piping system is used to circulate hot water in winter and chilled water in summer. Convectors with adjustable-speed fans act as room distributing units.

For ventilation, fresh filtered air from a main ventilating fan is introduced to the convectors through small flexible tubes. This air passes over the convector coils and is either heated or cooled.

Water for the heating system is heated with steam in a B & G Type "SU" Heat Exchanger. Steam is also used to heat the service water by means of a storage tank with a steam coil installed.

Architects: Maher & McGrew, Evanston, Ill. Construction Engineers: Heller, Rich & Bladon, Chicago. Heating & Air Conditioning: C. W. Johnson, Inc., Chicago. Plumbing: O'Callaghan Bros., Chicago.

BELL & GOSSETT
COMPANY
Dept. DV-4, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto

Modern bank shows how you can provide

Ideal indoor weather for the most modern kind of building

Why Honeywell Customized Temperature Control is a "must" in modern buildings

THE need for a truly modern control system is well illustrated by the New York City Fifth Ave. branch bank of the Manufacturers Trust Company.

The building was designed with drama in mind, is open and inviting to the public—and is a highly efficient work place for the bank's staff.

Important in making a building attractive and efficient today is ideal Indoor Weather—the kind furnished by Honeywell Customized Temperature Control in the Manufacturers Trust Company's Fifth Ave. branch and in many other buildings across the country.

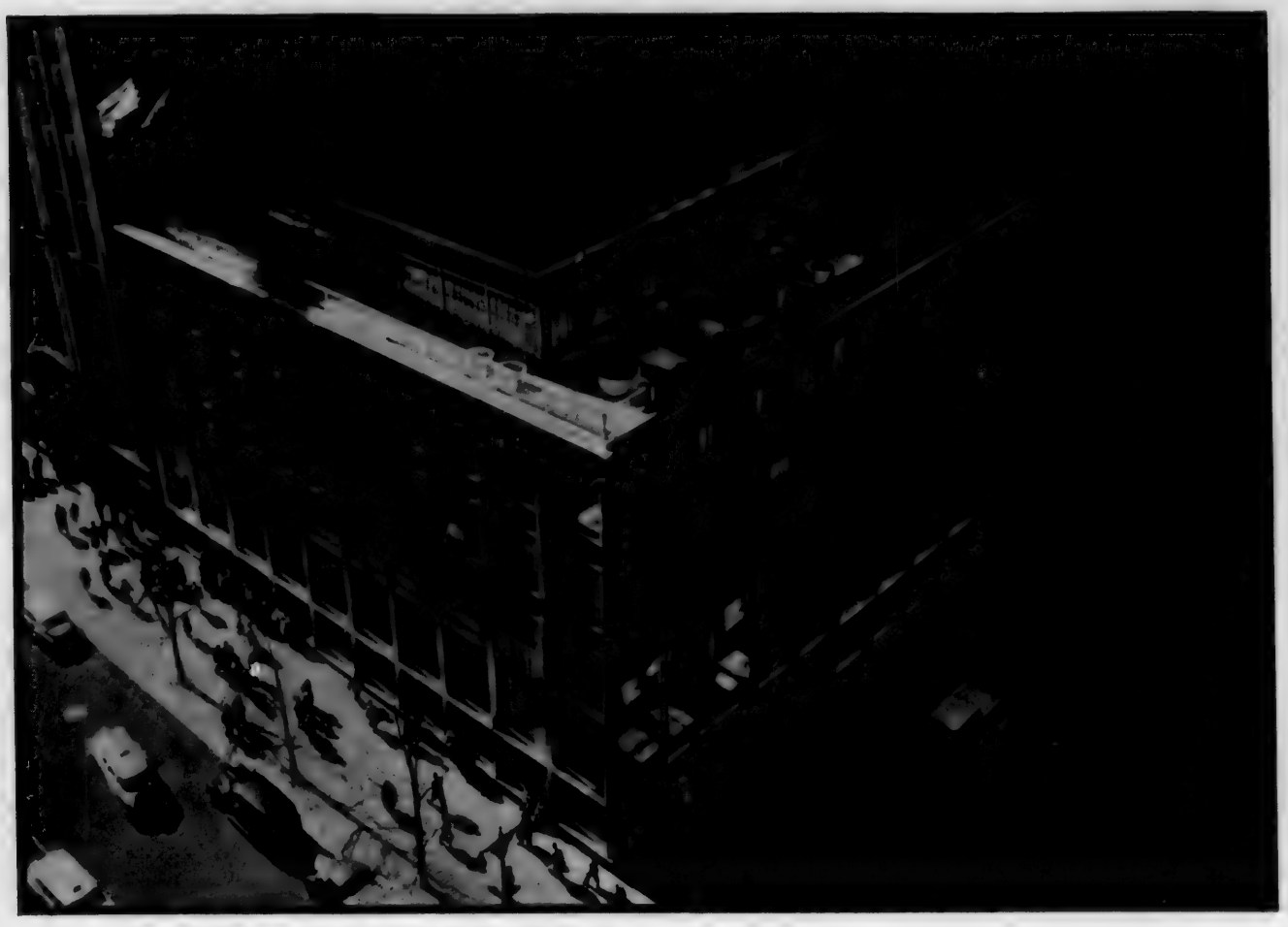
Strategically placed Honeywell thermostats (see floor plan) compensate for every possible occupancy, exposure and use comfort factor, making this new branch bank one of the world's most comfortable places to work and to do business in.

The *techniques* used in solving these comfort problems can help you provide the Indoor Weather required for your clients' facilities—for a Honeywell Customized Temperature Control installation is *designed to fit the needs of the building and its occupants*. This applies not only to heating and cooling, ventilating and humidity control, but to industrial control as well.

Only Honeywell can provide true "customized" control. Because only Honeywell manufactures all three types of controls—electronic, pneumatic and electric.

A separate thermostat system was installed in the conference room above to provide comfort no matter what the weather—or size of the gathering. The sensitive Honeywell thermostat calls for just the right amount of heating, cooling or ventilating—according to the season and size of the meeting. Thus Honeywell Customized Temperature Control meets the varying needs, compensating for occupancy as well as the season.

Strategically located thermostats in large banking areas such as the one shown provide comfort at all times. They do this by compensating for exposure, occupancy—and for varying crowds at different times of the day. In addition, comfort is maintained in private offices (see floor plan) by installation of a thermostat in each office. This meets the needs of individual offices—and of the individuals who occupy them.



Large glass areas create an inviting open look. But they also admit a great amount of solar heat, and transmit winter chill. This calls for Honeywell Customized Temperature Control—if comfort is to be assured.

TOP FLOOR PLAN

Skidmore, Owings & Merrill, architects. Weiskopf & Pickworth, structural engineers. Syska & Hennessy, mechanical & electrical engineers. George A. Fuller Co., builders.

For comfortable, more productive temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's a bank, church, school, office, motel, hospital, factory—any building of any size—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

You can give your clients more comfort and efficiency, and they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, and the economical Honeywell Periodic Maintenance Plan, call your local Honeywell office. Or write Honeywell, Dept. HV-4-56, Minneapolis 8, Minnesota.

MINNEAPOLIS
Honeywell

Customized Temperature Control

H HONEYWELL *112 offices across the nation*

Delivery...ON TIME...

A delay on this particular job meant valuable time lost . . . dollars wasted . . . Ric-Wil, not only prides itself in offering the finest in prefabricated insulated piping, but takes pride in ON TIME DELIVERY . . . and speaking of delivery . . . the best way to meet piping construction schedules is to contact your Ric-Wil representative early in the planning stage. He will be glad to help on scheduling delivery . . . and "lend a hand" on technical information as well.

Now Ric-Wil catalog is available . . . write for your copy . . . now.

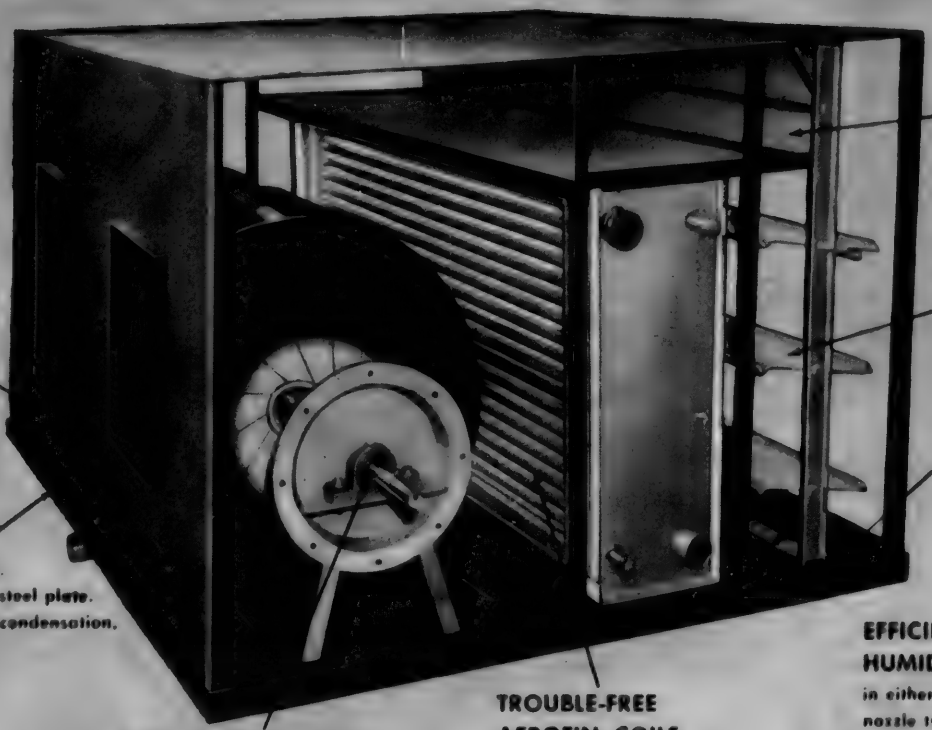
Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

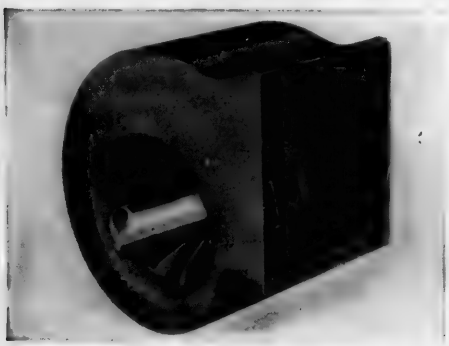
RIC·WIL INCORPORATED

PREFABRICATED INSULATED PIPING SYSTEMS

BARBERTON, OHIO

"Buffalo"





STABLE, EFFICIENT, QUIET DELIVERY, with "Buffalo" mixed-flow fans — much more efficient than forward curve wheels and can be operated at higher pressures and speeds at lower noise level.

The above view of a "Buffalo" PC Cabinet (with side panels removed) shows why these units give *lasting satisfaction on the job.* It's part of what we call the "Buffalo" "Q" Factor*. From filter box to outlet, construction is both heavy-duty and convenient for maintenance. You'll like their ease of installation, too — this horizontal PC Cabinet can be placed directly on the floor or suspended. And where space is short, use "Buffalo" VPC Cabinets. These vertical models are in three demountable sections for moving in thru standard building openings. All models available with air washer sections, too, if desired. Capacities from 875 to 22,000 cfm. *Bulletin 3703A* gives full details. Write for your copy!

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

BUFFALO FORGE COMPANY

480 BROADWAY BUFFALO, N. Y.

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

The JOHN SEALY HOSPITAL

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Architects
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Mechanical Engineers
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Dallas, Texas

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Dallas, Texas

One of the most important features of his 1000 bed hospital valued highly by patients and staff alike is: It is completely air conditioned throughout and Powers controlled.

Left: View of Entrance Lobby with Portraits of the Founder, John Sealy, Sr., and John Sealy, Jr.

Below: Post Operative Recovery Dept. has nine beds.

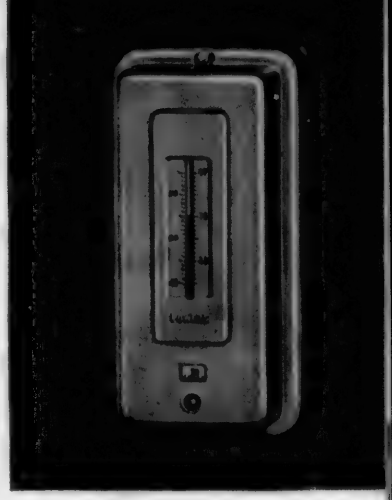
Below: Research Laboratory

Below: Surrounding Corridors for Central Operating Rooms

Behind the scenes in this modern hospital

POWERS Automatic TEMPERATURE and HUMIDITY Control

is contributing to the quality of patient care



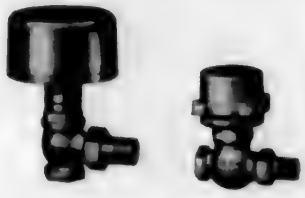
Radial Type Surgical Department shown in drawing below, is one of the many new concepts incorporated in this center for healing.

The radial type plan is based on a theory of centralization permitting a compact layout to increase nurses' efficiency by reducing their steps. Powers automatic control of the working climate further increases staff efficiency and contributes to the health and comfort of the patients.

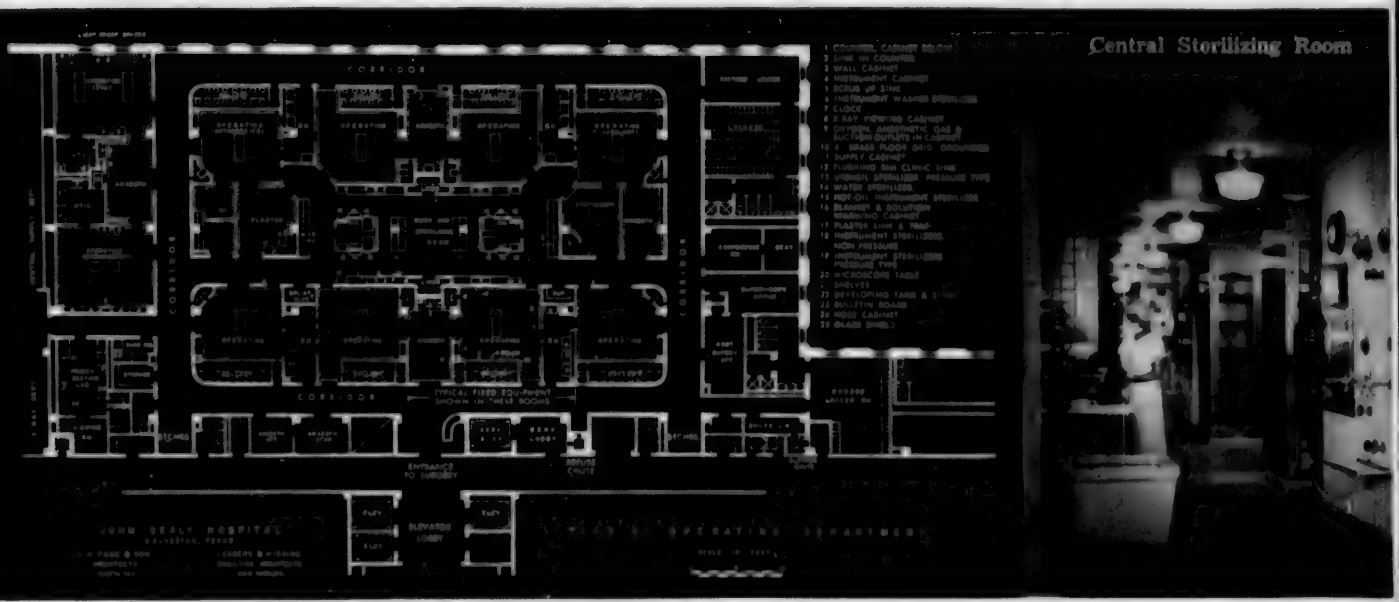
Being completely air conditioned the building requires 1250 tons of refrigeration.

Almost 700 Powers Gradual Acting Thermostats here control 125 Damper operators and 930 PACKLESS Valves on air conditioning units and convectors. Other controls consist of 7 Series 100 Master-Submaster Controller Recorders, Pressure Indicating Controllers and 70 Powers FLOWRITE Diaphragm Valves.

(c14)

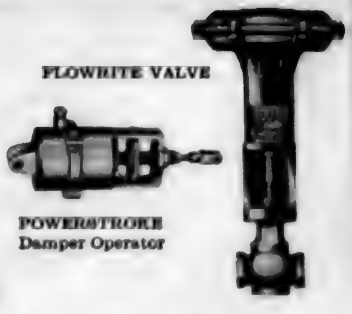


Powers PACKLESS Control Valves — one of the many superior features of a Powers control system. They eliminate packing maintenance and leakage of water or steam and give smooth accurate control.



Consult Powers when you want thermostatic control for any type of new or existing building. No other firm makes as big a variety of temperature controls for heating and air conditioning systems, shower baths, hydrotherapy, X-Ray film developing, water heaters, fuel oil preheaters and other hospital applications.

For further information call your nearest Powers office or write us direct.



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SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

See your phone book

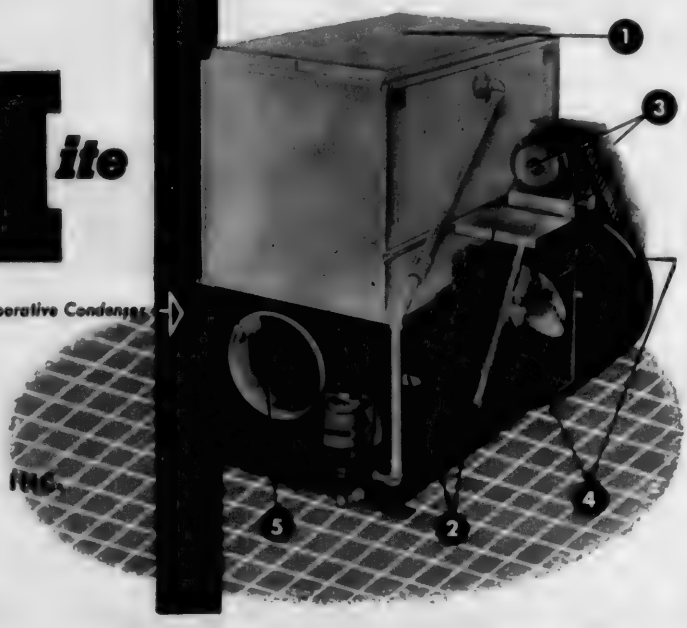
More than 60 years of Automatic Temperature and Humidity Control

...the most accessible Evaporative Condensers and Cooling Towers on the market today!

B.A.C.

Mighty-Mite

1. **Sectional Construction** makes Eliminators easily removable for inspection and maintenance of sprays, coils and/or tower surface.
2. **Step and Platform** permit access to top of unit without use of ladders.
3. **Fan Motor and Drive** easily reached for adjustments.
4. **Fan Bearings** easily accessible for oiling.
5. **Access Port** permits easy access to sump for adjustment of float valve and cleaning of strainer and pan.



Model "MMC" Mighty-Mite Evaporative Condenser

Write for Details

BALTIMORE AIRCOIL COMPANY, INC.

2621 Mathews Street

Baltimore 18, Maryland

UNARCO

ROYAL-AIRE *a distinctive conditioner*

featuring UNARCO "pump-down" control system

It is doubtful that any air conditioner can match the efficiency and beauty of the UNARCO ROYAL-AIRE. This all-new conditioner provides "just right" cooling comfort, adding distinction to *any* setting.

Oversize cooling coils . . . accessible, hermetic motor-compressor units... and the exclusive UNARCO "pump-down" control system, which prevents compressor damage... are but a few outstanding features of the ROYAL-AIRE line.

Available in five capacities (3 to 15-ton) the ROYAL-AIRE is *balance-engineered!* This insures full cooling capacities and quiet operation under all conditions, producing a pleasurable climate and atmosphere for any size room.

The ROYAL-AIRE is eminently suited to comfort-cool dining rooms, taverns, drug stores, clothing stores, and offices... to cool wherever the *ultimate* in efficiency and long life is desired. Address Heating & Cooling Division for descriptive literature.

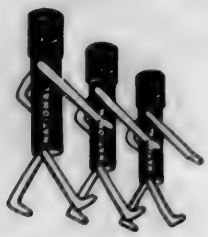
Union Asbestos & Rubber Company
332 So. Michigan Ave., Chicago 4, Ill.
Canadian Representative: Albern Universal Ltd., Toronto

UNARCO ®

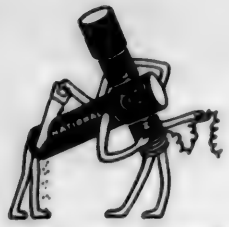
the *finest* in heating and cooling products *at no extra cost*

In all types of building and industrial applications...

NATIONAL PIPE IS CHOSEN CONSISTENTLY *because*—

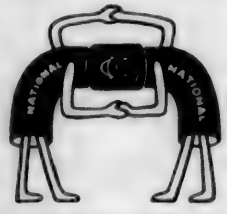


It's uniform throughout—National Pipe is uniform in metallic structure, ductility, strength, corrosion resistance, surface finish and diameter.

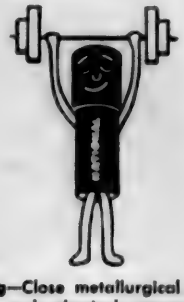


It threads and cuts easily—Absence of slag inclusions, laminations and blisters assures smooth, strong threads . . . clean cuts.

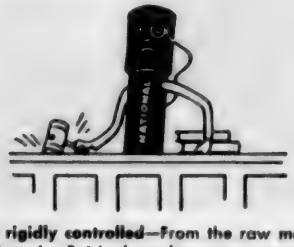
It coils and bends well—National Pipe has that extra strength and ductility so necessary to meet the demands for smooth, uniform coils and bends.



It makes sound joints—Uniformity and accuracy in manufacturing have made unequalled pipe jointing records for National Pipe . . . whether welded or threaded.

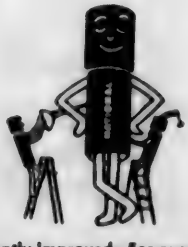


It's strong—Close metallurgical control of chemical and physical properties gives National Steel Pipe "built-in" strength.



It's rigidly controlled—From the raw material to the finished product, one organization has rigid control over the manufacturing steps that produce National Steel Pipe.

It's thoroughly tested—Each and every stage of production is carefully checked by the finest instruments . . . the most experienced men.



It's constantly improved—For over 60 years, National Steel Pipe has constantly been improved to meet the most difficult requirements.

It's gained nationwide acceptance—A cross section of industrial or building applications will show a predominant use of National Pipe . . . largest selling pipe in the world.

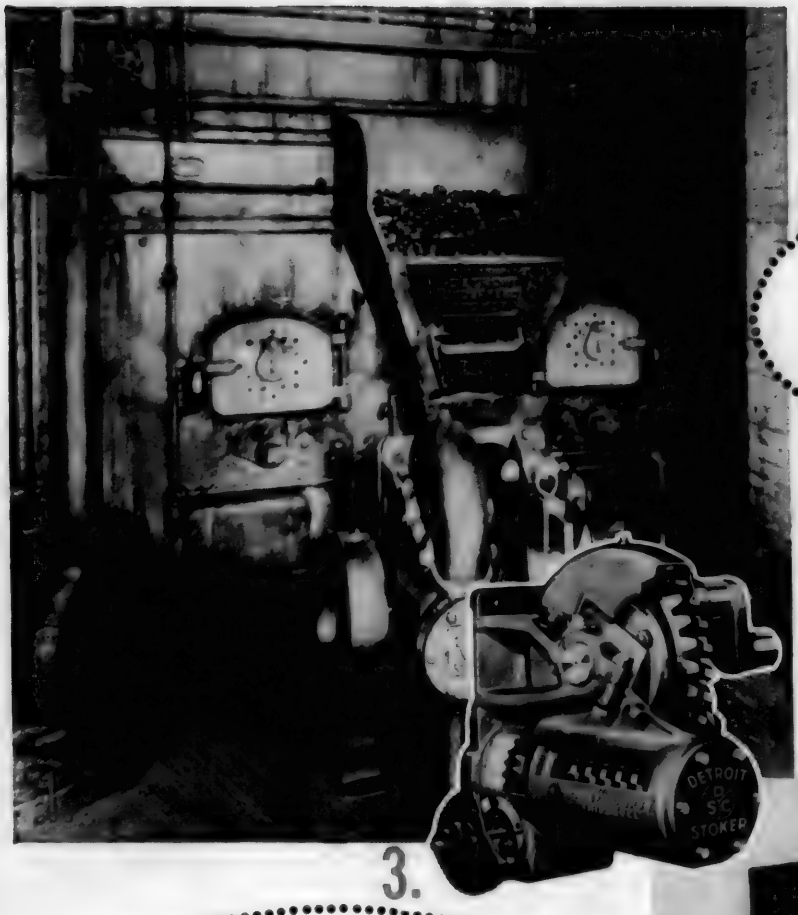
NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL *Steel* PIPE

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

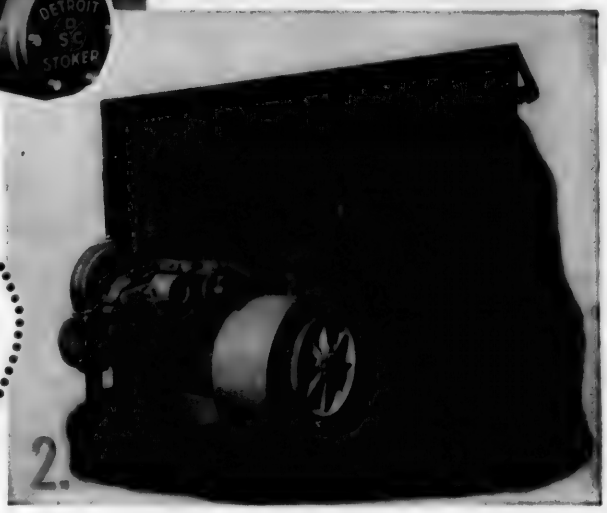
UNITED STATES STEEL



3.

28 YEARS OLD

still going strong
typical of
Detroit Stoker
durability



2.

1. Detroit UniStoker at Troy Laundry — Detroit in excellent condition after 28 years of dependable operation.
2. Latest Model Detroit UniStoker with Hi-Tuyeres and Adjustable Feed Control.
3. Dependable Mechanical Drive with machine-cut worms and gears, fully enclosed that run in oil.

One of the many examples of Detroit Stoker durability. The above Detroit UniStoker was installed in the Troy Laundry at Detroit in 1926. A fast service laundry, it must be sure of steam six days a week and depends entirely upon the UniStoker. The owners say it has given excellent service day after day for 28 years.

Detroit Stokers are built to outlive the boilers they serve . . . a long time, profitable investment.

Detroit Stoker engineers keep pace with modern requirements. For example, the latest type Detroit UniStoker with Hi-Tuyeres and Detroit Adjustable Coal Feed Control meet these modern requirements with more capacity and higher efficiency.

There is a size and type of Detroit Stoker for all capacities up to approximately 400,000 pounds of steam per hour.

Write for recommendations. No obligation.

DETROIT
SINCE 1898
STOKERS

DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.
Works at Monroe, Mich. • District Offices in Principal Cities

16 big advantages ... the new Trane Climate

Meet wider capacity needs, closer space requirements . . . get more features that give you greater flexibility, easier installation!

600 to 29,000 cfm—*with 20 new* TRANE *Climate Changers! This line is so complete it's like having equipment tailor-made to your needs!*

You get *all* the features for complete design flexibility, full accessibility, less maintenance. You get *sectionalized construction* to help you meet close space requirements. (All units clear 36" door except sections of largest unit which clear 40" door.) You get any or all of *24 practical combinations* of heating, cooling, humidification, dehumidification, ventilating, filtering—and in the *exact degree* you demand! You get *the one line that's unmatched anywhere, in any way, for versatility!*

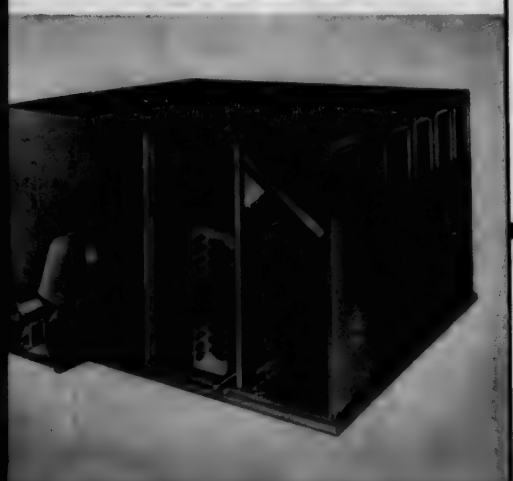
Want more facts? See your nearby TRANE Sales Office or write TRANE, La Crosse, Wis.

EVERY FEATURE TO MAKE YOUR JOB EASIER!

1. **Rotatable fan discharge** for greater design flexibility.
2. **Laboratory rated fan** is rated *in the unit* to assure *guaranteed performance.*
3. **Adjustable motor mounting** permits standard motors to be used on all units.
4. **Welded construction** of fan section adds rigidity for long, efficient operation.
5. **External bearings** for easier maintenance.
6. **Extra-large fan shaft** minimizes vibration, helps assure quiet operation.
7. **Choice of humidifiers**—water spray, steam pan or steam grid types.
8. **Sloping drain pan** under entire unit assures positive drainage.
9. **Side drain connection** saves head room.
10. **Choice of casings** — horizontal or vertical, to fit the physical requirements of the job. (Horizontal model illustrated)
11. **Choice of heating coils**—steam or hot water; three types.
12. **Choice of cooling coils**—water or D.E.; five types.
13. **Exclusive Delta Fin Fin** coil has greater heat transfer efficiency, added strength.
14. **Face and by-pass dampers** with external by-pass for modulating control.
15. **Choice of filter boxes**—high or low velocity; permanent or throwaway-type filters.
16. **Optional mixing box** designed with filter frame eliminates need for separate filter section.

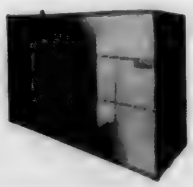
AND IT'S EXTRA QUIET! *Every fan designed especially for its unit for highest efficiency, quietest operation. Low outlet velocities (approximately 1,500 fpm at 500 fpm coil face velocity), extra large, solid steel shafts and rugged welded construction combine to assure quietness that lasts!*

Multi-Zone Climate Changers provide a number of zones with different climates at the same time.

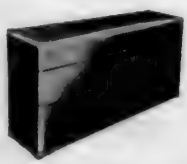


A TRANE PRODUCT FOR EVERY AIR CONDITIONING

CenTraVac centrifugal water chillers, 45 to 400 ton capacity.



Self-Contained air conditioners from 3 to 20 tons capacity.



UniTrane room units for air conditioning multi-room buildings.

in one air conditioner Changer

NEED

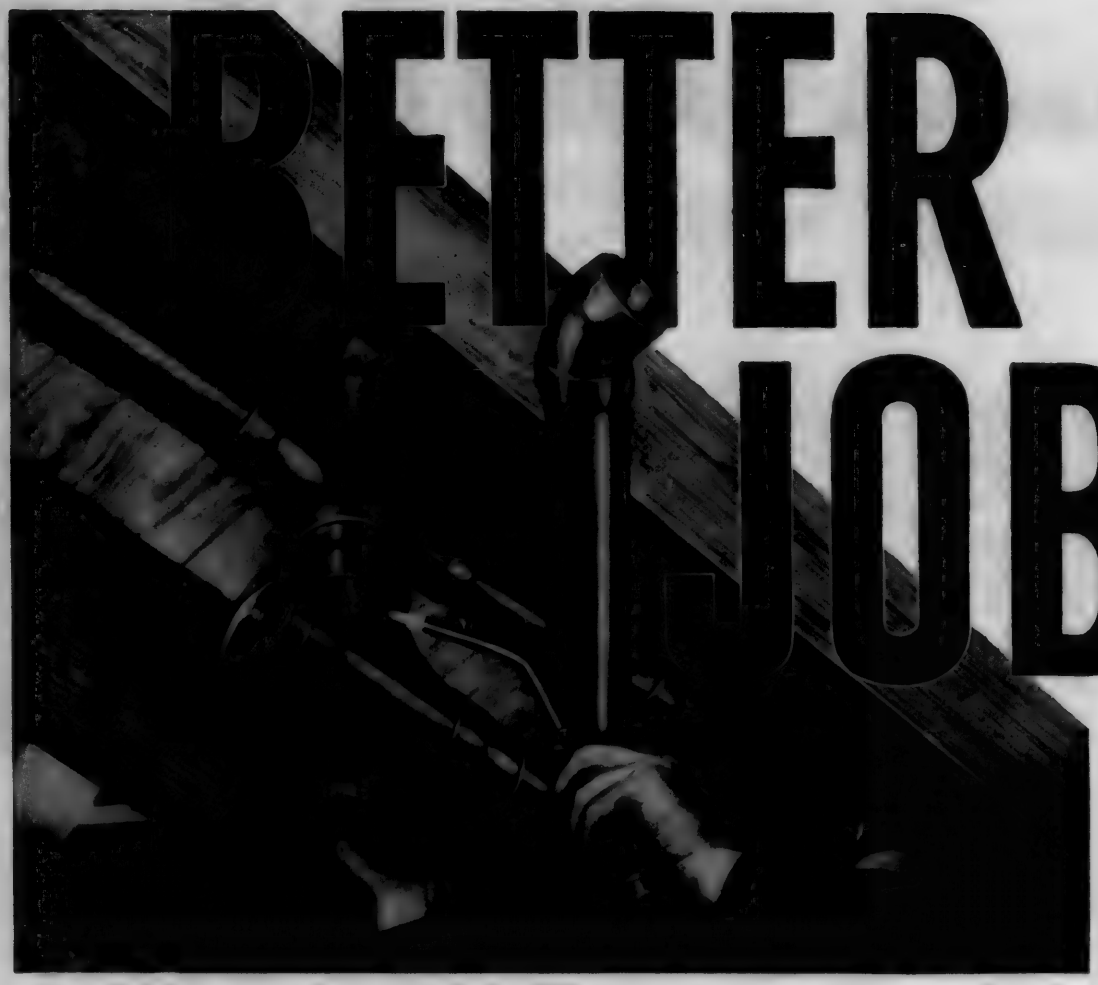
Cold Generator factory-assembled water chillers, 10 to 100 tons.

TRANE

MANUFACTURING ENGINEERS

One source, one responsibility for: Air Conditioning • Heating • Ventilating • Heat Transfer Equipment

The Trane Company, La Crosse, Wis. • Eastern Mfg. Div., Scranton, Pa. • Trane Co. of Canada, Ltd., Toronto • 90 U.S. and 17 Canadian Offices



CHASE copper tube for soil, waste and vent lines at little or no extra cost!

Consider *installation* costs, and you'll see why a Chase quality drainage system will cost little or *no more* than an ordinary system. Actual comparisons *prove* this!

Chase 3" Copper Drainage Tube fits *within* standard partitions, eliminates costly furring-out construction required with ordinary systems.

The *inside* of a Chase Drainage System is also worth talking about—Chase Copper Tube and Solder-Joint Fittings have no internal projections to trap waste—they provide fast, even drainage and make a neater, more compact job all around.

Your Chase Wholesaler has a complete line of Chase Drainage Tube and Fittings. Order them from him for your next job!

Chase

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

Chase® Copper adds extra value to any home!

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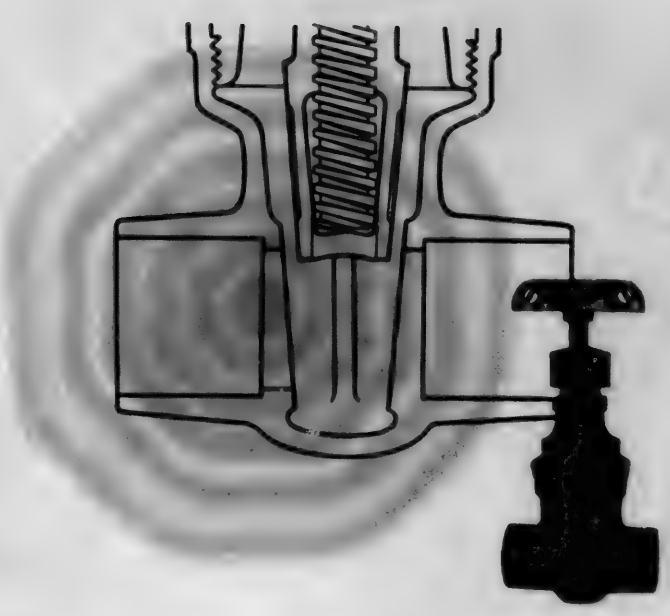
When the heat's on

you need the extra strength of

JENKINS

Solder and Socket End

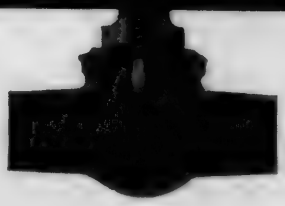
VALVES



Solder End GLOBES and ANGLES

300 lbs. O.W.G.
¼" to 3"

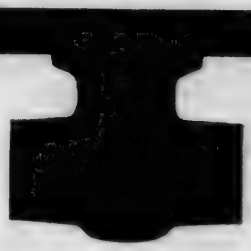
Fitted with Renewable Composition Disc.



Solder End GATES

225 lb. and 300 lb. O.W.G.
⅜" to 3"

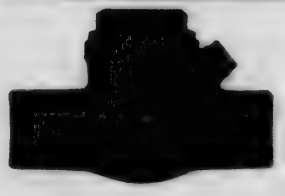
With solid or split wedges, and stationary or traveling spindles.



Solder End CHECKS

300 lbs. O.W.G.
¼" to 3"

Regrinding. May be easily reground without removal from line.



NEW BULLETIN Lists all Jenkins Solder End and Socket End Valves and gives complete instructions for soldering and brazing. Ask for Solder-Socket End booklet.

The "light-duty" look of copper tubing installations is deceiving. Valves must provide an accurate fit to tubing and *hold it* under the intense heat of soldering. And, because flexible tubing does not afford the rigid support of standard pipe, valves must withstand unusual strains in operation.

Jenkins Solder End Valves are engineered to meet these demands with strength to spare. High tensile bronze castings have liberal dimensions for extra rigidity. Smooth, clean bores assure accurate fit, easy soldering, positive seal to types K, L, and M Copper Tubing.

For faster, trouble-free installation, and lasting economy, specify Jenkins Solder End Valves. Jenkins Bros., 100 Park Ave., New York 17.

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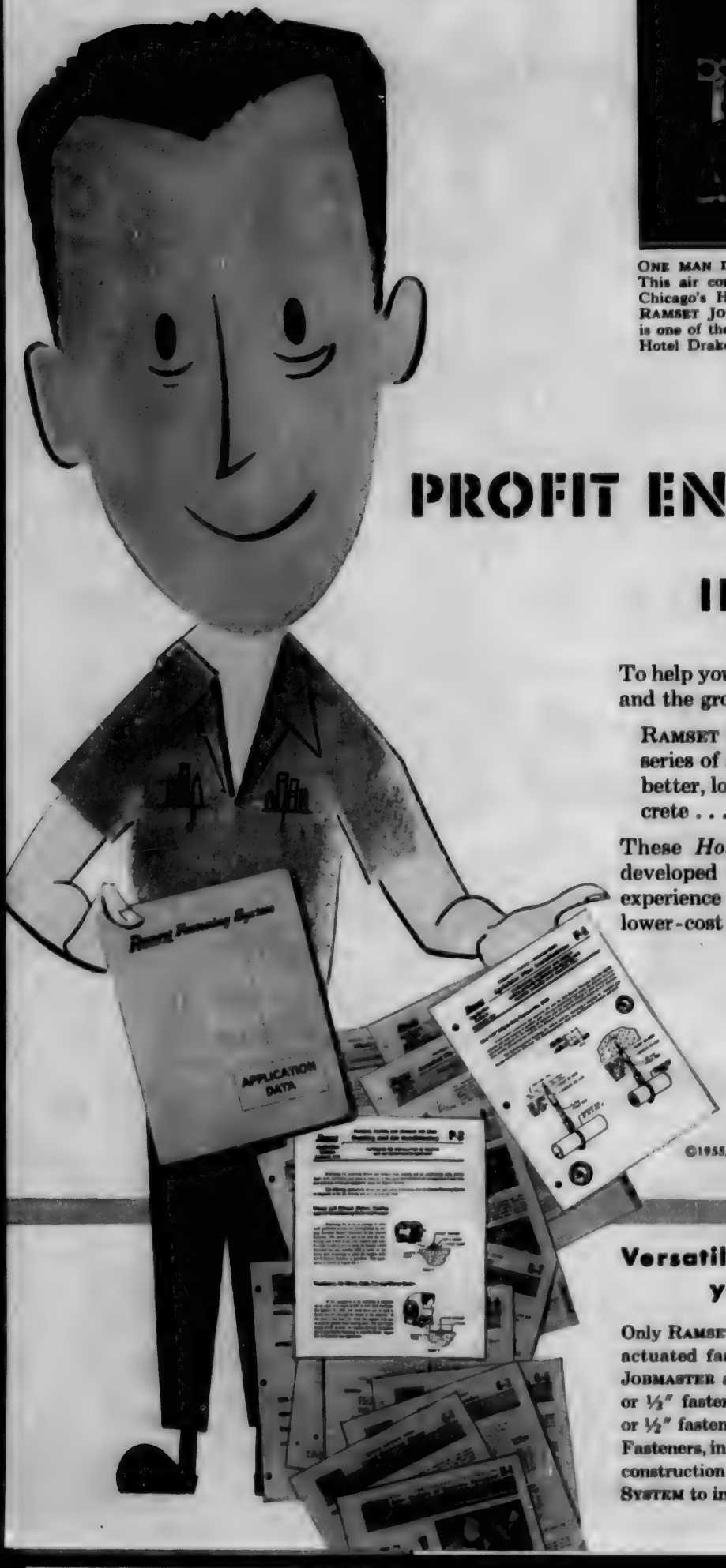

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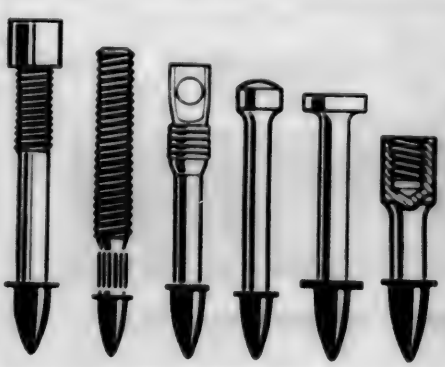

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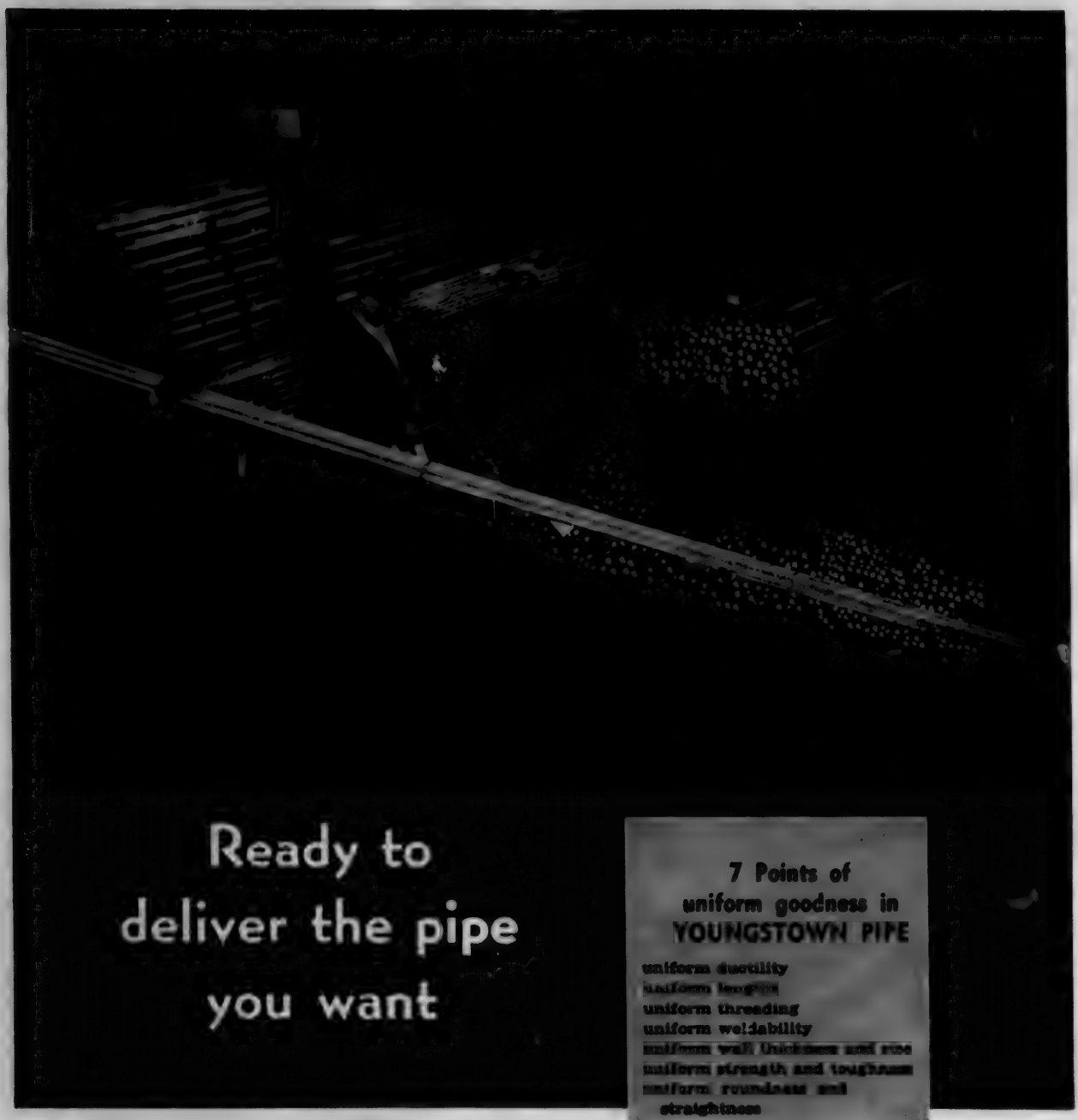

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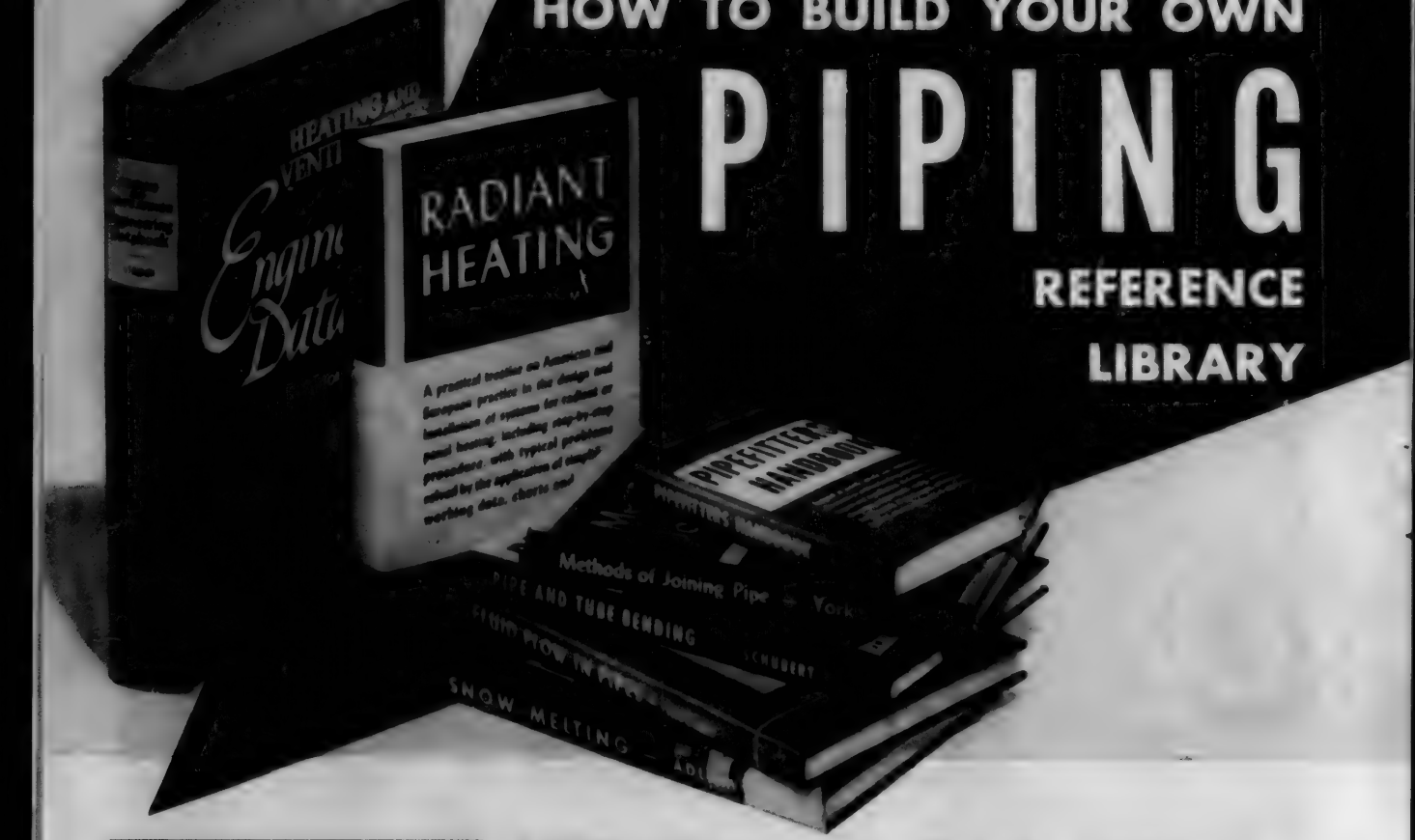
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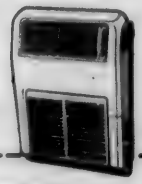

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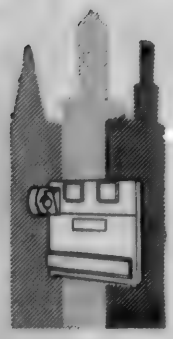

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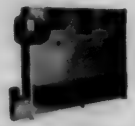

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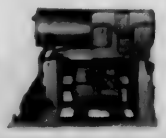

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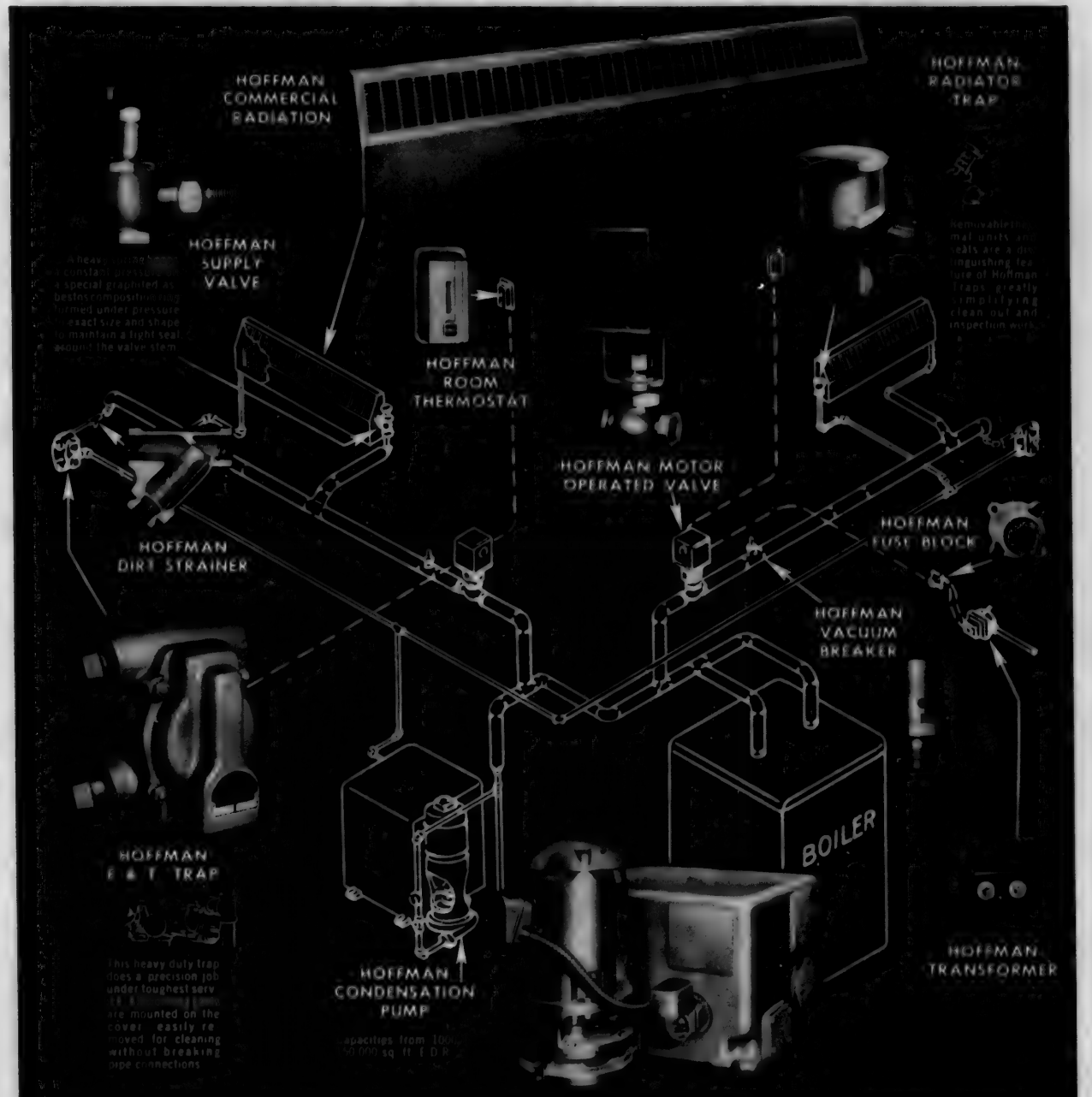

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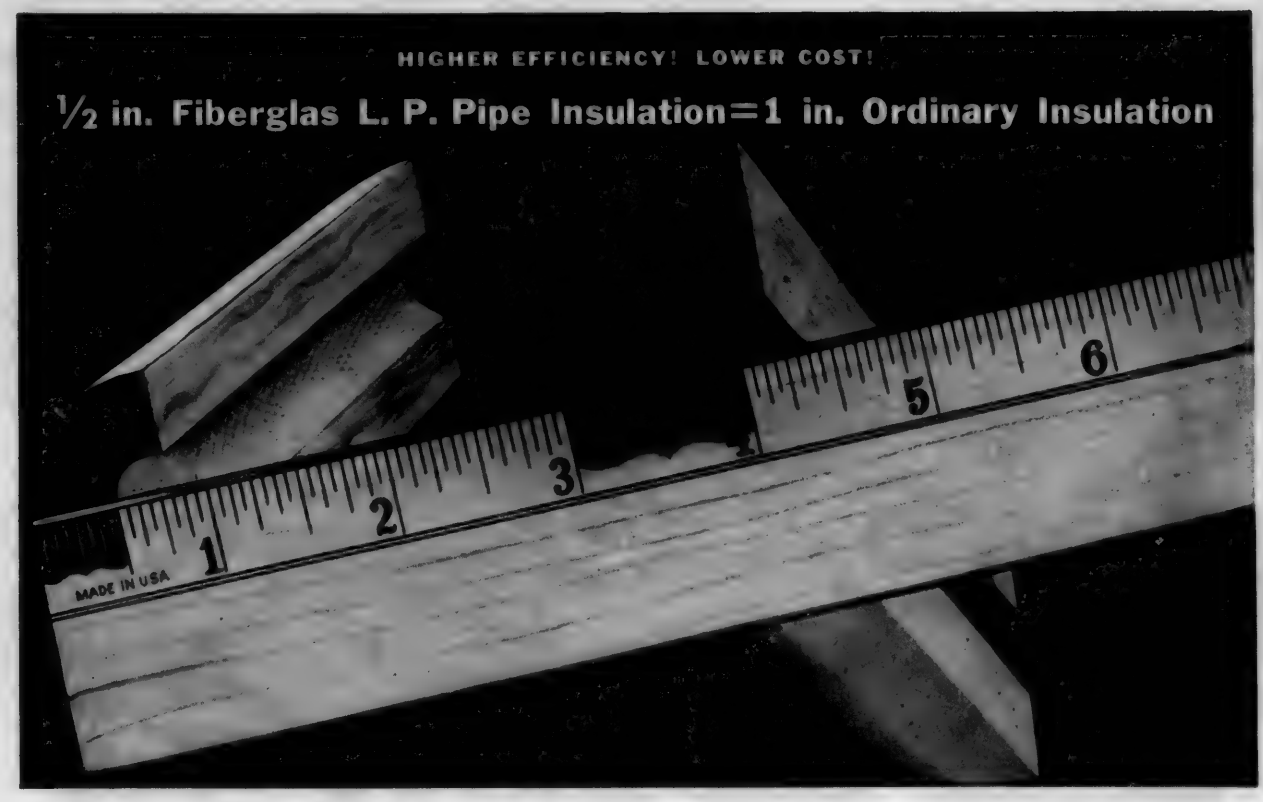

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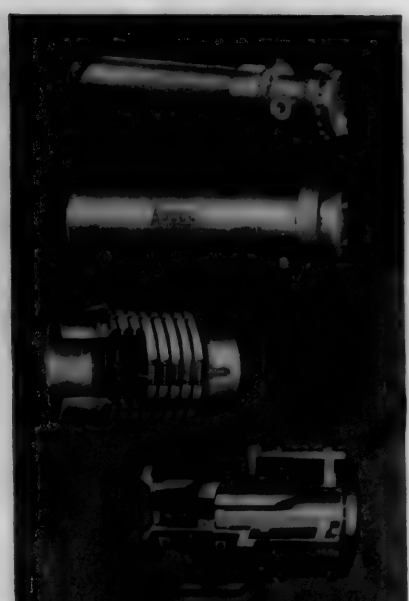

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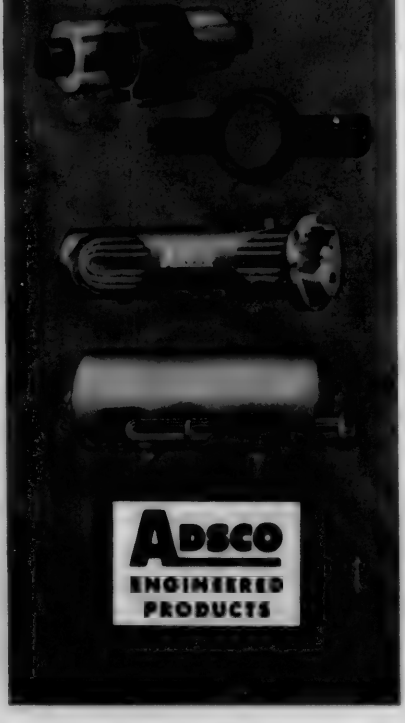

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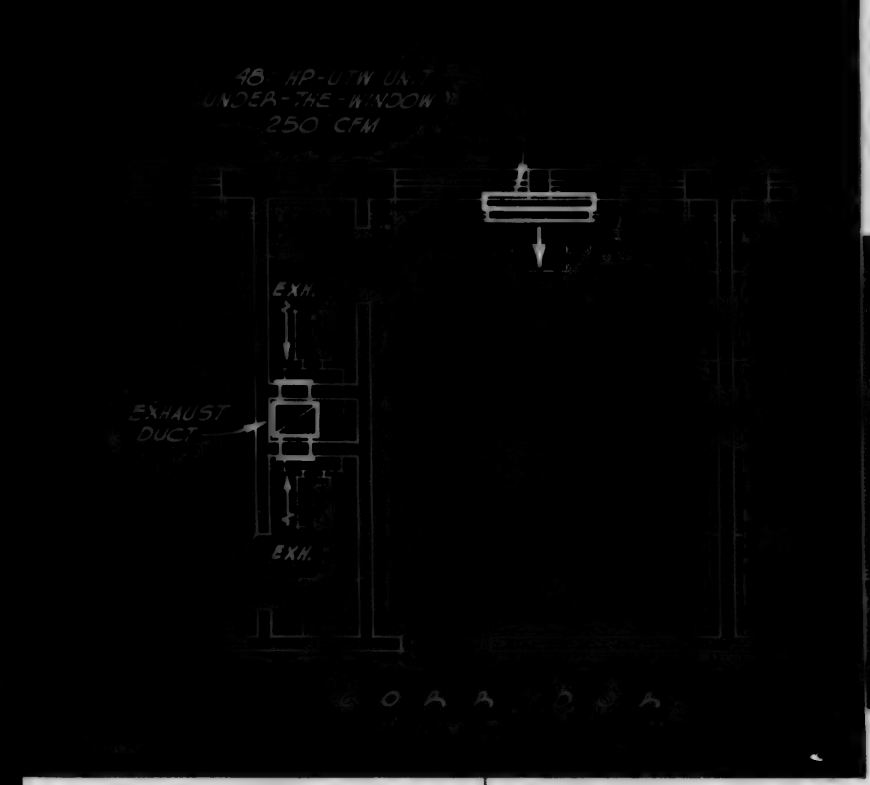

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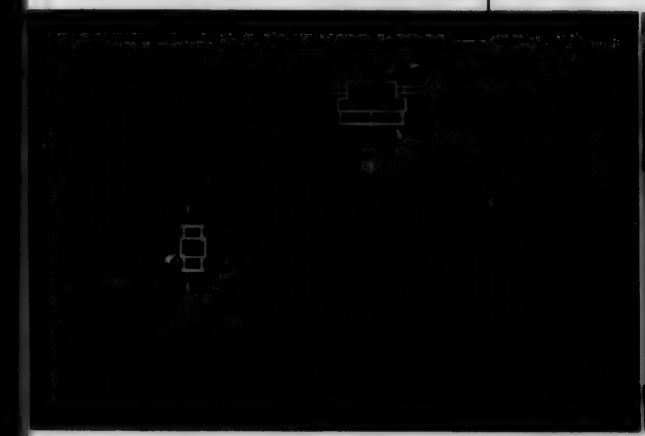

• ***For latest data on All-Air High Velocity units,*** **write on your business letterhead for *new Selection Manual 50* to Anemostat Corporation of America, 10 E. 39 Street, New York 16, N. Y.**

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Blows it's TOP

As PART of the plans to make the Rock Island Works of the J. I. Case Company the most up-to-date plant in the farm implement industrial field, Architects Eschweiler & Eschweiler of Milwaukee specified 15 Gallaher Air-Van ® power exhausters to handle the ventilation. Twelve of the units are rated at 10,000 cubic feet per minute, another at 3,700 CFM, the other two at 2,800 CFM each. Gallaher units were specified because positive air removal is essential for employee comfort, and only Gallaher Air-Vans® with built-in scroll effect are performance-rated by actual physical tests. It's why the plant engineer has had no maintenance problem with the Air-Vans® after a year of operation.

Patents 2188741 2526290.
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More and more engineers and architects are realizing the value of Gallaher Power Exhausters. The patented scroll effect design and the air seal-off, low silhouette, low noise levels, availability in special metals, weatherproof design—these are some of the features that have made Gallaher a recognized leader in the field of industrial ventilation.

Direct Drive units 150-11,000 CFM. Belt Drive 3500-65,000 CFM, developing static pressures to 4".

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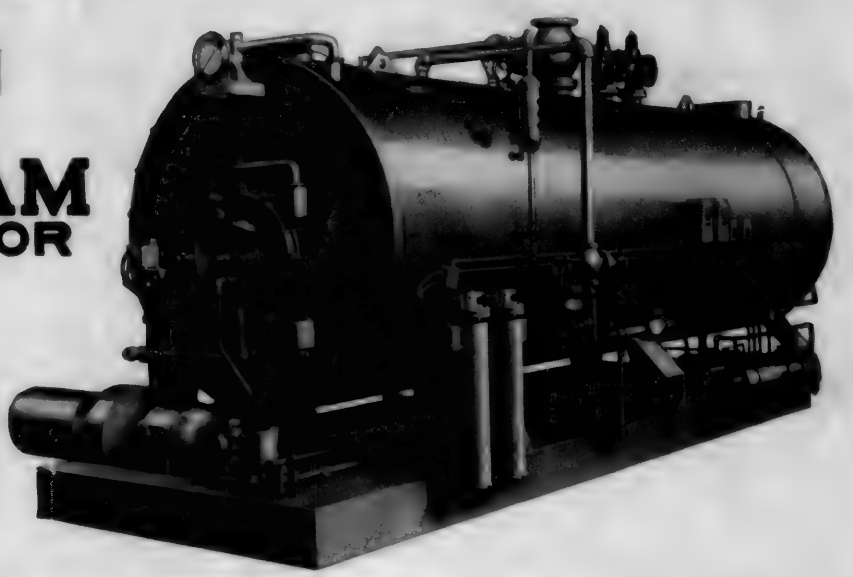

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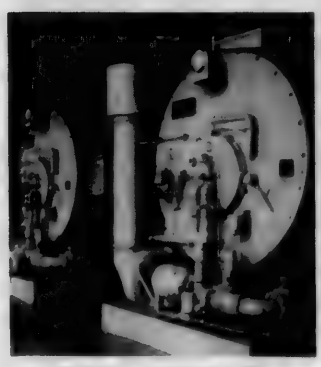

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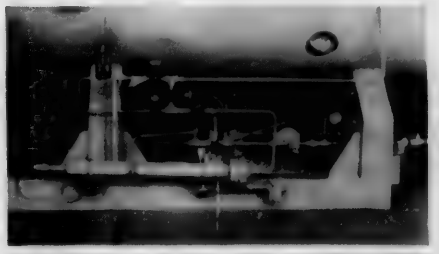

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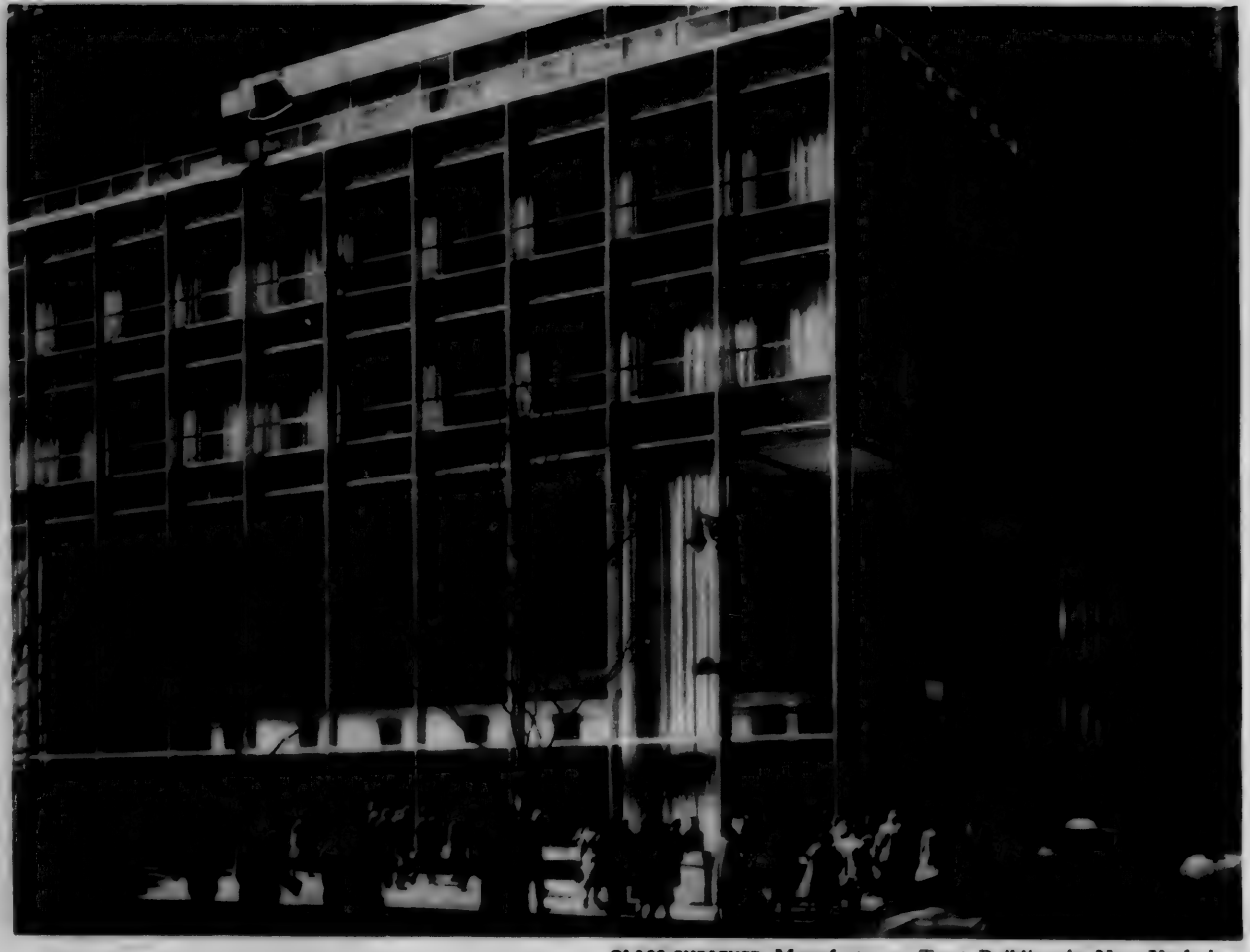

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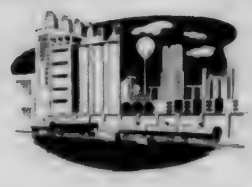
Corrosive  *fan installations can be permanent*

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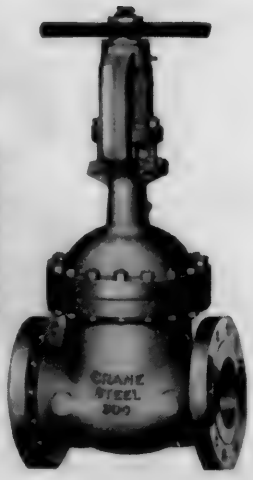

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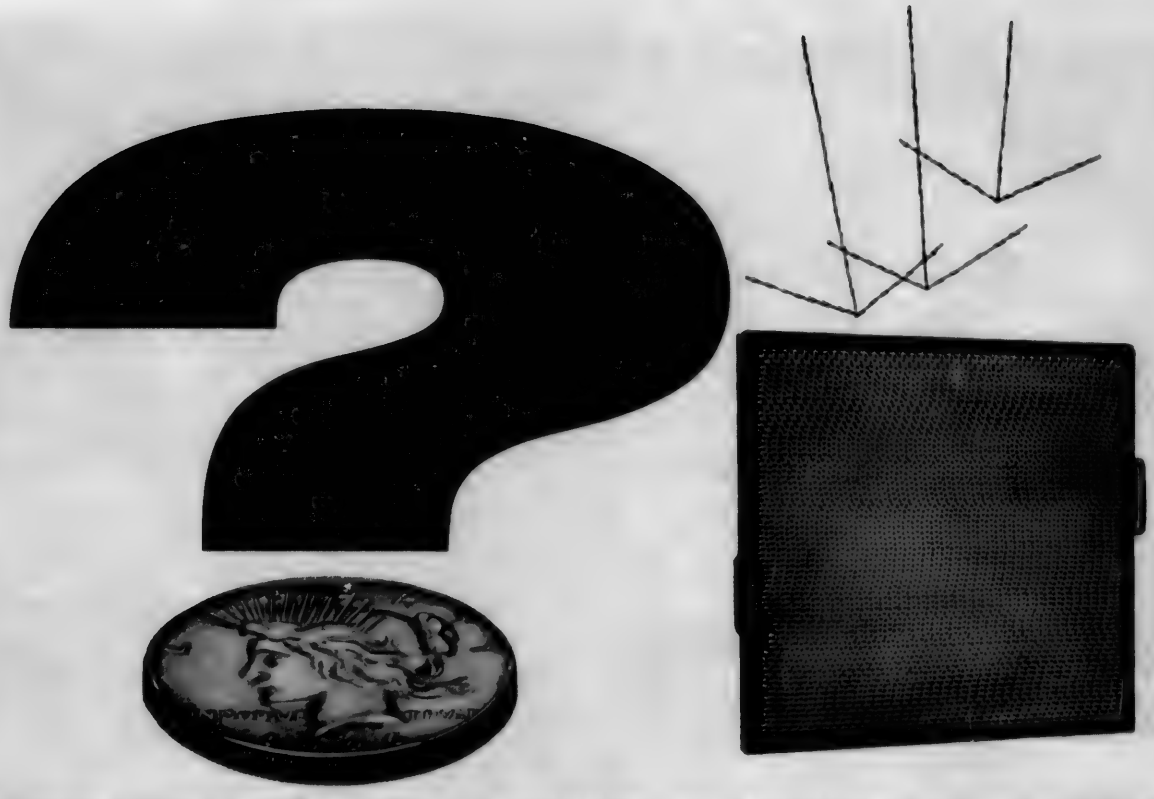

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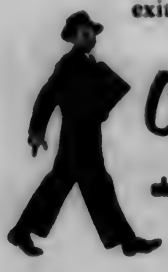

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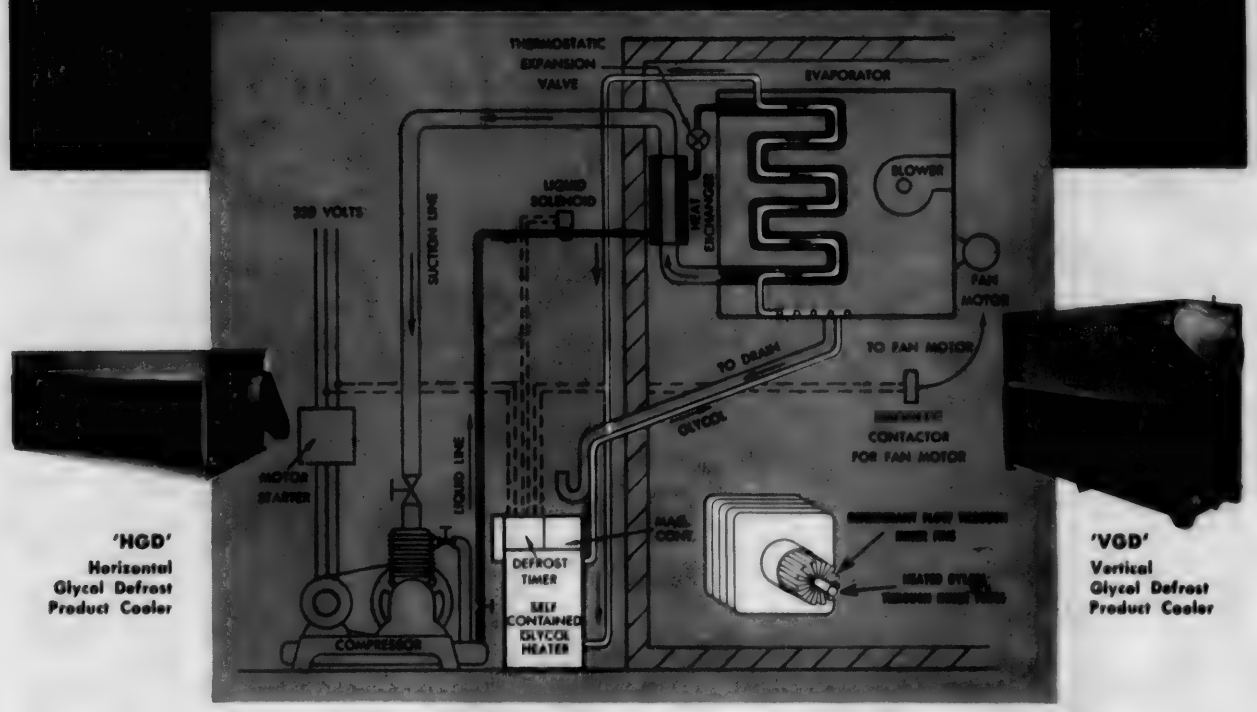

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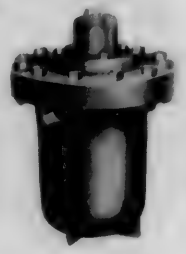

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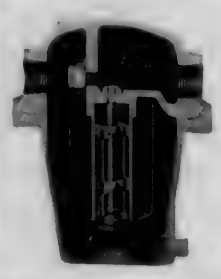

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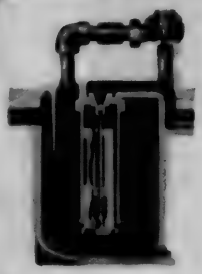

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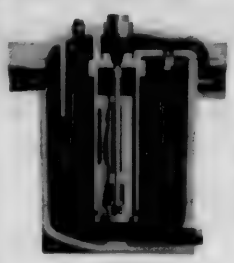
For pressures up to 30 pounds



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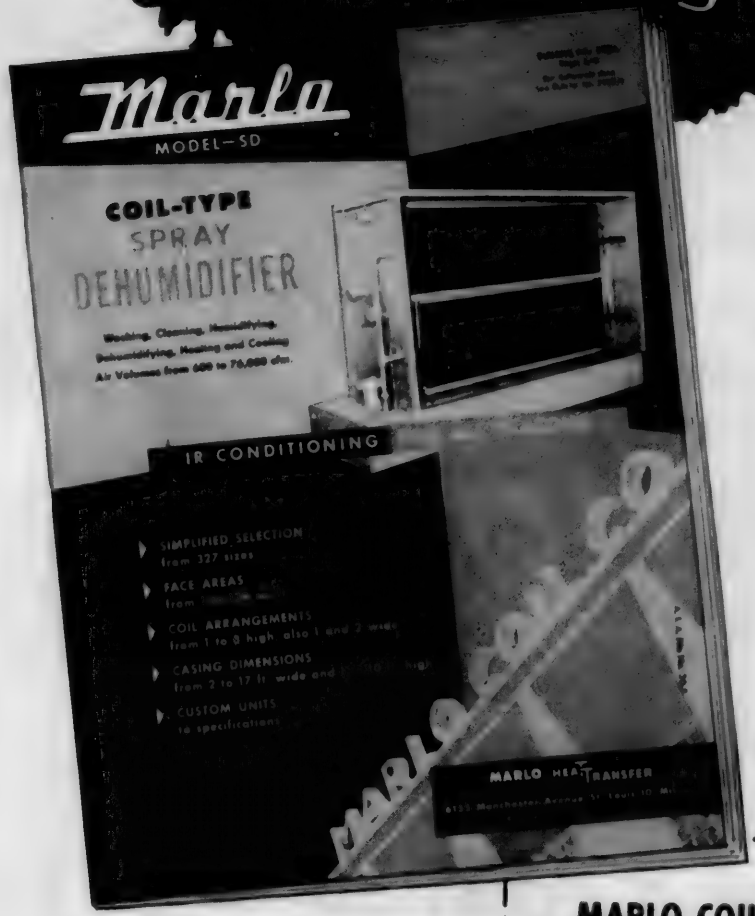

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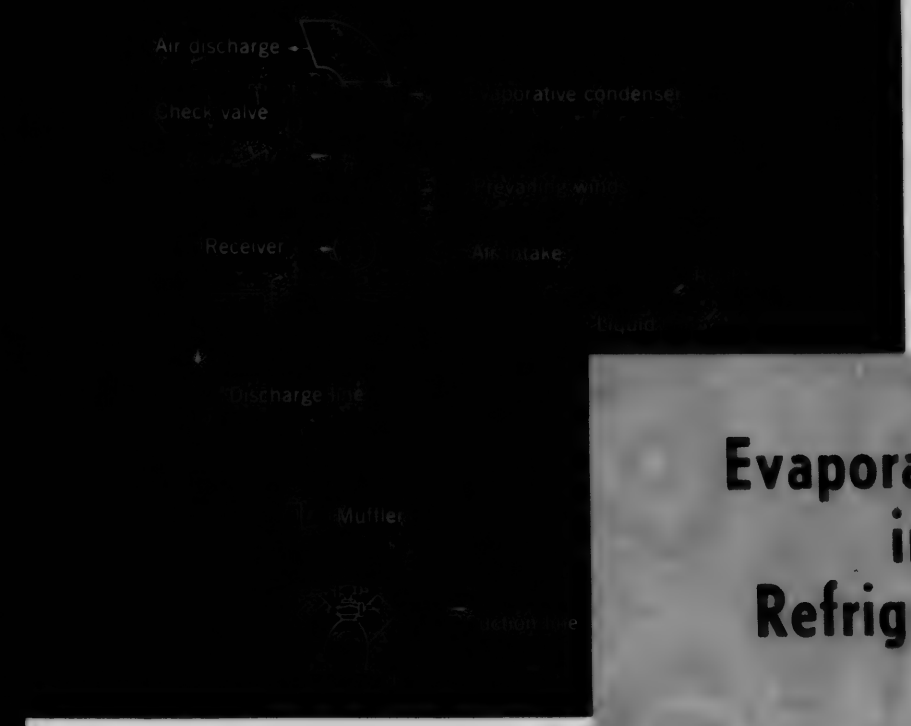

Fig. 1. Arrangement of a condenser on a roof above the compressor, with check valve in the discharge line.

Evaporative Condensers in Freon-12 Refrigerating Systems

O. B. WERT

Manager, Technical Data and Training Section,
Air Conditioning and Refrigeration Division,
Worthington Corporation, Harrison, N. J.

This article shows how to install evaporative condensers in refrigerating systems using Freon-12, and where to place the various components that are part of the evaporative condenser, in order to obtain the best results. Information is included on the use of several condensers, either of the same or different types.

EVAPORATIVE condensers, in recent years, have gained wide acceptance in commercial and industrial refrigeration and in air conditioning systems because of restrictions placed on the use of water and charges for its sewage facilities by municipal ordinances.

An evaporative condenser is in reality an induced draft cooling tower and refrigerant condenser in one package. The chief advantage of this unit over a shell and tube condenser and cooling tower combination is the elimination of extensive water piping and large pumping costs. Only enough water is required to keep wet the condenser coil surface.

The space chosen for this condenser has a very definite effect on the proper functioning of the refrigeration system of which it is a major component. Greater consideration must be given to its location and installation than to that of other types of condensers.

This condenser design has been standardized by most manufacturers into a line of units to cover their activities in the air conditioning and refrigeration industry. The selection of the proper size unit is simple. It is only necessary to know the condensing load in Btu per hour, the condensing temperature desired, and the design wet bulb temperature of the locality. With these data, the published rating charts of any make condenser are easily utilized.

Sketches and information are presented to better understand and possibly eliminate any potential operating difficulties. The purchaser or his supplier must decide on the best location for the unit and proper installation with required accessories as related to a particular job. The initial cost and operating expense will vary somewhat with the arrangement of the condenser with respect to the other parts of the refrigerating system.

The more important accessory parts that may be required with a system using this type of condenser are: Liquid receiver, check valve, oil separator or oil trap, muffler, and control devices.

Location of Condenser

The condenser may usually be located in two relative positions with respect to the compressor or compressors which it serves:

(1) Above the compressor.
(2) At the same elevation.

The condenser may present additional engineering problems according to the particular installation.

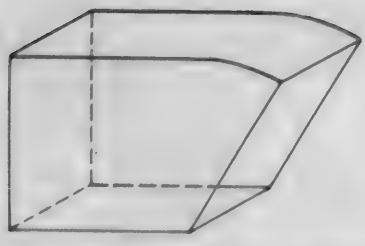

Fig. 2. Typical air discharge cowl.

(1) It may be located indoors or out-of-doors.

(2) It may serve more than one compressor.

(3) It may be an addition to an existing plant having existing shell and tube or evaporative type condensers.

(4) More than one condenser may be needed to handle the condensing load.

(5) The wet bulb temperature may vary over a wide range throughout the operating seasons.

A survey of the proposed site must be made carefully to determine whether air of suitable wet bulb condition can be economically conducted to the unit and after the air has become laden with moisture while passing through the unit, whether it can be discharged so that no recirculation of the moist air will occur. Since a large quantity of air is required per ton of condenser capacity (200 to 600 cfm per ton refrigeration), this will be a prime factor in its location.

The safe floor and roof loadings must be checked and reinforcing steel beams or other types of supports located where the engineer finds it necessary to carry the added weight.

Condenser on Roof

Locating the condenser on the roof of the building housing the compressor and its driver will usually result in the greatest economy of operation. If the unit is installed in such an area, it should be placed so that surrounding buildings do not interfere with the air supply or exhaust. The condenser should also be placed so that prevailing winds will blow toward the air inlet as indicated in Fig. 1. This will aid the fans in drawing air over condenser coils and through the water spray.

An air discharge cowl similar to the one shown in Fig. 2 should be installed on the unit with its outlet protected by a wire mesh screen to prevent any extraneous material or objects entering the fan section of the condenser.

In the event that the access of free air to the unit is limited, an air duct must be installed to bring fresh air to the intake openings. The duct increases the friction of the air circulating system, and lowers both fan volume and condenser capacity. The best way to handle the problem is to increase the fan speed to bring the amount of air up to design cfm.

If the condenser is to have a long operating life, the air introduced to the unit must be free of any corrosive fumes that may be present in the atmosphere from neighboring industrial plants.

Liquid Receiver

The liquid receiver size is largely determined by the design and operation of the evaporator used on the system. While it is desirable to have a shell that can hold the entire refrigerant charge of the system, it is more commonly sized if it is designed to act as an operating receiver and to absorb the seasonal fluctuations in liquid refrigerant requirements.

The receiver, if mounted external to the condenser casing, may be located where the ambient temperature is higher than the condensing temperature. However, when the system is in continuous operation and the refrigerant liquid drain line is large enough to permit free draining of the liquid refrigerant from the condenser to the receiver, no difficulty is experienced. The receiver should be protected from the direct rays of the sun to prevent excessive temperatures and loss of capacity due to absorption of heat by the liquid. It is desirable in some cases to insulate the receiver to eliminate this condition.

When the system shown in Fig. 1 is not operating, it is possible for the condenser to be at a higher temperature than that of the compressor, causing some of the liquid refrigerant in the receiver to become a vapor, which if not restricted, will flow back through the condenser coils and discharge gas line to the compressor. The gas in the cool pipe line in the building may condense and collect in the compressor heads. This will result in serious damage to the compressor when it is again put into operation. If such conditions exist, the installation of a check valve in the gas line close to its entry into the condenser is recommended. Figure 1 shows the check valve in its correct location. This valve will stop the gas flow and will prevent any liquid refrigerant finding its way to the compressor.

Use of an Oil Separator

In a refrigerating system, an oil separator has two main functions:

(1) To separate oil from the discharge gas of the system.

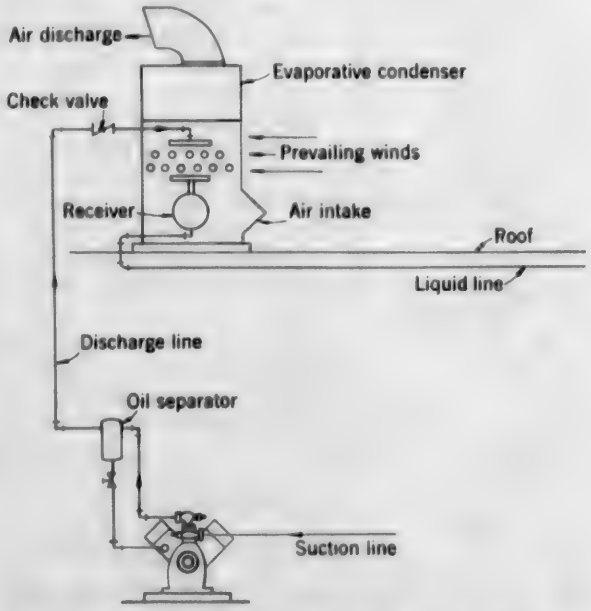

Fig. 3. Arrangement of condenser on roof above the compressor with an oil separator in the discharge line.

(2) To act as a muffler in dampening out discharge gas noises.

In a Freon-12 system, the oil normally travels with the refrigerant, and the need for an oil separator depends on the low side or evaporator design. If the oil will not return automatically through the suction line to the compressor, an oil separator must be included in the discharge piping. Where there is any doubt at all, about the return of oil to the compressor, an oil separator should be included.

In installations where the discharge line is long and oil can collect therein during the off-cycle, and then flow backward to the compressor, an oil separator as shown in Fig. 3 or a trap as in Fig. 4, with a muffler in place of the oil separator, should be installed. Either should be placed in the hot discharge gas line near the compressor. By providing a resevoir for the accumulated oil, the trap or oil separator will prevent discharged oil from draining back to the cylinder head. Where a loop is used, as in Fig. 4, and a sufficient quantity of oil has collected in the system to trap the line before the compressor is turned on, the oil will be carried over to the condenser and be recirculated with the refrigerant. The oil separator, as shown in Fig. 3, will drain the collected oil to the compressor. The oil should be returned to the point on the compressor recommended by its manufacturer. If neither of these methods are utilized, damage to the compressor may occur when it is put into operation.

If an oil separator is not required for the system, a muffler should be installed on all refrigeration cycles having evaporative condensers. Its best location is to place the muffler as close to the compressor discharge valve as possible.

Systems using evaporative condensers should be provided with interlocks to prevent the compressor from running before the evaporative condenser fan and spray pump are operating. If units are outside the machine room, remote push buttons with pilot lights can be installed to indicate whether or not they are operating.

The make-up water for the unit is regulated by a ball float valve located in the drain pan. An arrangement similar to that shown in Fig. 5 may be used.

Maintaining Proper Condensing Pressures

Excessively low condensing pressures such as might occur during Spring and Fall operation, must be avoided to maintain sufficient pressure at the expansion valve and other refrigerant control devices which regulate the flow

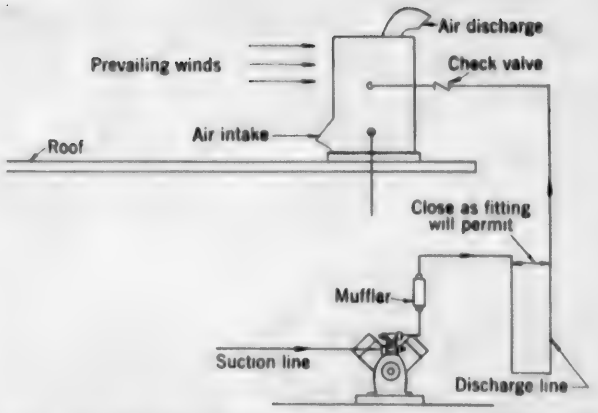

Fig. 4. Typical piping diagram with muffler and pipe trap in discharge line instead of oil separator.

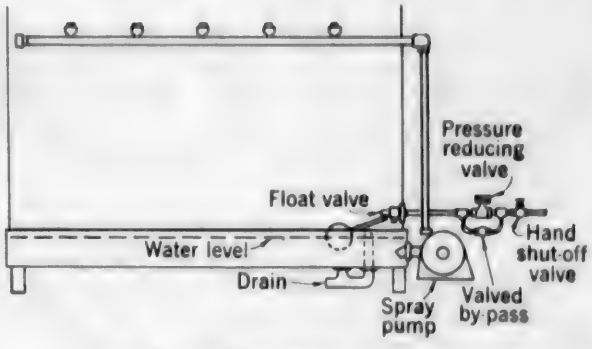

Fig. 5. Spray water system for condenser.

of liquid to the evaporator. By decreasing the air flow with the use of air-inlet dampers, it is possible to maintain condensing pressures for this purpose. Dampers may be operated manually or automatically. As the wet bulb temperature drops, the damper will maintain constant condensing pressure by partially closing and thus reducing the air supply.

Condensing pressure may also be maintained by intermittent operation of the spray pump, fans, or a combination of both, by means of a pressure switch. This can be accomplished by allowing the fan or pump motors to operate at the lowest condensing pressure that will insure proper liquid feed to the evaporator. An alternate arrangement may be used so that water will only be allowed to flow over the condenser coil surfaces when the con-

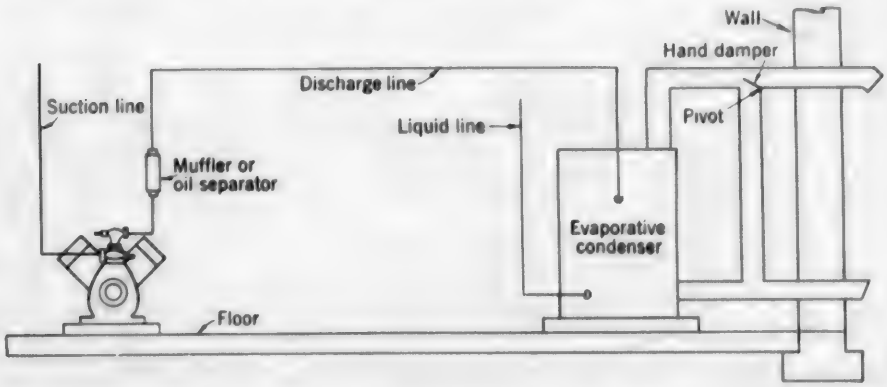

Fig. 6. Condenser located indoors on same level as compressor.

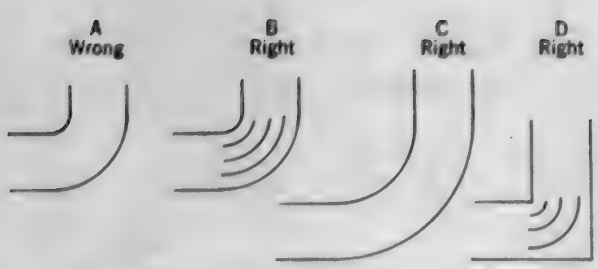

Fig. 7. Type of ells recommended.

denser pressure has reached a fixed predetermined point.

The sump pan and water lines must be drained and the control so designed that the spray water pump may be shut off during the winter season or when the air temperatures are likely to fall below 32F. The condenser thus becomes an air cooled unit but it will rarely have its full rated capacity even under extreme low outside temperatures. The ratio of dry coil capacity to normal wetted capacity can be obtained from the manufacturer's ratings.

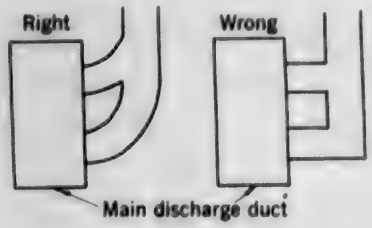

Fig. 8. Typical arrangement for combining two discharge openings on condenser into one discharge duct.

Location of Unit

Evaporative condensers may be installed indoors when fresh air can be brought in and discharged to the atmosphere without recirculating the same air. Figure 6 shows a typical placement of this kind.

When the unit is located at or about the same level as that of the compressor, piping is done in the same manner as for any condenser. A muffler or oil separator should, in all cases, be installed in the discharge gas line.

As the discharged air will be nearly saturated with water vapor, it should not be exhausted where condensation would be objectionable.

Indoor Installation

When the unit is situated in the engine room, it may serve in ventilating the machine room since compressors are often confined to a small area. To prevent an excessive load on the building heating system in cold weather, the unit should have an outside air duct.

Since on indoor installations, ducts are often required for intake and exhaust, they should be carefully planned to prevent excessive friction losses. Fan speeds and motor sizes must both be checked as previously discussed in this article.

Where units with more than one fan discharge opening on the unit are installed with the discharge openings manifolded together, be sure that the connections from each fan are brought into the main duct at an angle to the duct as shown in Fig. 8 and not directly as illustrated. Figure 7 shows the type of ells to be used.

Use of Several Evaporative Condensers

Where it is necessary to have two compressors and two evaporators to handle the refrigeration load, an evaporative condenser with two coil circuits should be used. These two circuit units are constructed by dividing the total con-

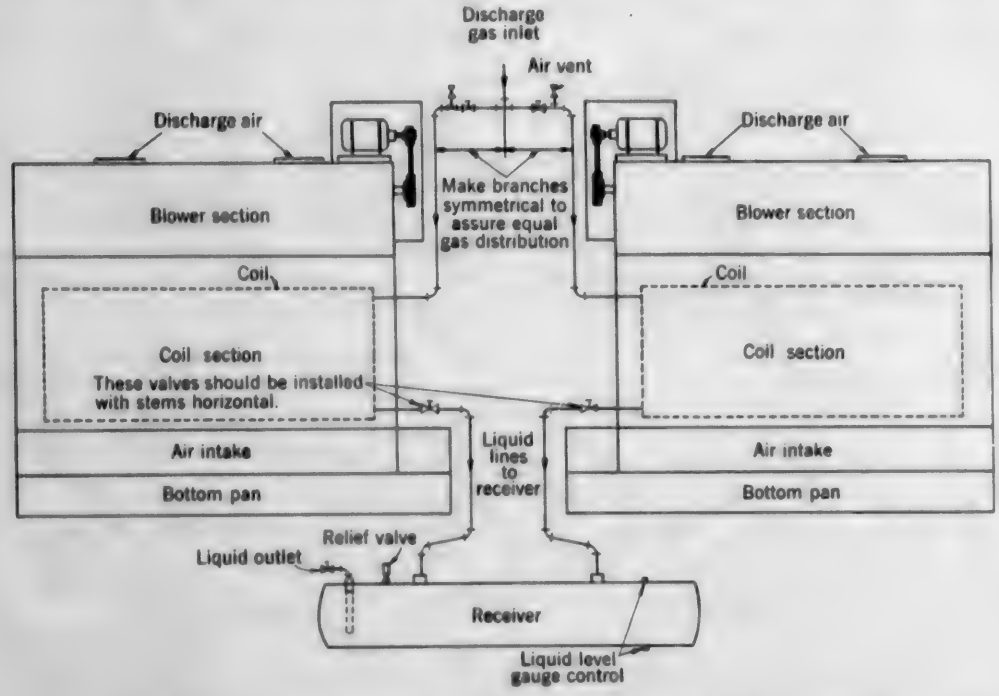

Fig. 9. Schematic arrangement of two condensers in parallel with one receiver.

densing coil surface into two coils, and providing separate inlet and outlet connections on each coil. The system control should be so set up, that the evaporative condenser fan motor and spray water pump remain operating as long as the compressor in either circuit is operating. Since the refrigerant cycle is completely separate, a liquid receiver must be used with each circuit. The same rule applies to oil separator, check valve and muffler where these are needed.

So many problems of refrigerant piping must be considered where several evaporative condensers are interconnected, it is wise to avoid this type of system. Design the installation for individual compressor and evaporative condenser or use multiple compressors with two-circuit condensers.

If it is necessary to inter-connect these condensers, the system should be designed to equalize the pressure drop through all coil circuits, and to properly distribute the refrigerant gas to each unit. Figure 9 shows the correct arrangement of two condensers connected in parallel with one receiver but, of course, the piping does not show the required equalization connections for the return of oil to the compressors.

When the capacity of an installation is increased by adding compressors and condensers, the design will be more complex. The pressure drop or length of coil circuit in the present condenser may not be known or the new ones cannot be furnished with the same size and length of coil. Adequate equalizing connections between discharge and liquid lines are excessive in first cost or practically impossible to make, due to the existing space requirements.

Evaporative Condenser Plus Shell and Tube Condenser

Designs involving these installations necessitate the use of separate systems. Due to the fact that the pressure drop through the shell and tube condenser on the refrigerant side is negligible, it will cause the backing up of the liquid into the coils of the evaporative condenser, greatly reducing its capacity.

Liquid Sub-cooling Coils

Liquid sub-cooling in an evaporative condenser is provided to either increase its capacity or to prevent flash gas troubles in the liquid line at the expansion valve. Figure 10 shows how to arrange a sub-cooling coil in the tank of a unit.

The suggested flow of liquid should be carefully noted for: (1) it flows from the bottom connection of the condenser coil to the liquid receiver; (2) the saturated liquid is piped to the inlet of the sub-cooling coil; (3) the sub-cooled liquid flows directly to the expansion valve. Where the liquid line is long and ambient temperatures high, most of the increased capacity will be lost. Sub-cooling for proper expansion valve operation should then be accomplished, in such cases, by the use of a suction heat exchanger.

Purging

The purge valve should be located at the highest point of the gas piping at the condenser, or on the top of the receiver, allowing removal of non-condensable gases from the system. When the valve is placed on top of the receiver, it should be as far away from the drainage point of the condenser as possible. This placement insures a more complete purging of air from the system with a minimum loss of refrigerant.

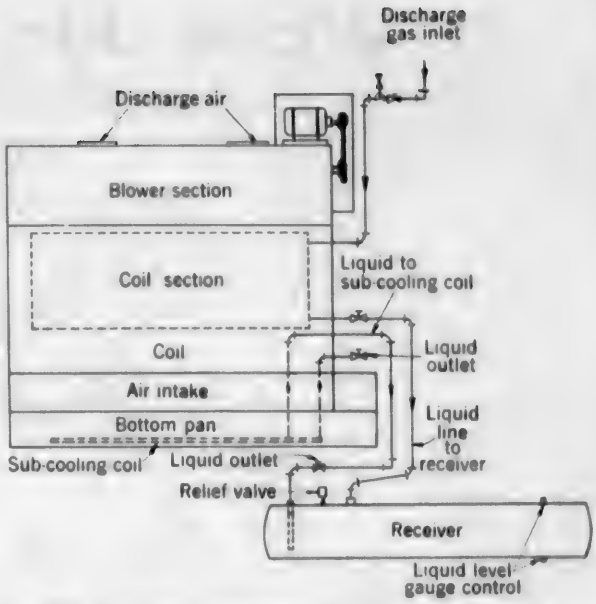

Fig. 10. Condenser arrangement with liquid subcooling coil.

Water Treatment

A spray water-bleeder or continuous overflow should be provided to decrease the deposits of solid concentrates in the spray water. Chemical treatment of the make-up water will prevent excessive amounts of salts collecting in the condenser.

The facilities of a company familiar with water treatment or the consultation with a chemist on this problem, are advisable for this aspect of operation. This move will show good results.

Maintenance

The maintenance of this type of condenser consists chiefly in keeping the fan and pump motors in good working order. The spray nozzles and pipes must be cleaned regularly and the eliminator plates properly conditioned. The casing of the unit should be coated with a reflective paint having good corrosive resistant properties when the unit is located out-of-doors. Metal parts exposed to the action of the recirculated water should also be processed to impede rusting.

Evaporative condensers provide a most satisfactory means for removing the necessary heat to liquify the refrigerant in a refrigerating cycle.

The condenser as designed and manufactured, fulfills all the requirements of existing conditions or potential conditions relative to its installation. Its space requirements, its flexibility to location, its saving on water by recirculation, its adaptability to winter operation, its easy conversion to serve multiple compressors, its low operating costs and finally its uncomplicated maintenance. All of these important factors add up to an economical, trouble-free condenser.

Water, Air, and Energy
A Psychrometric Review

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Whether air is to be heated or cooled, wetted or dried, or is to undergo a complex change involving both temperature and humidity, there is a very strong chance that the method used to accomplish the purpose will include the use of a controlled-temperature wetted surface. Here are the principles involved.

A WIDE variety of mechanisms is available for conditioning air through use or influence of a wetted surface. Air washers, gas scrubbers, wetted transfer surfaces, porous coils, spray ponds, and cooling towers are all—in a qualitative sense—alike in that respect. It is interesting and informative to note that, psychrometrically, all such devices are based on the same principles, and any differences, therefore, are largely a matter either of degree or of economic practicability.

Fundamental Principles

The controlled-temperature wetted surface accomplishes its purpose—whatever that purpose may be—by the action, either alone or in combination of one or more of three major characteristics:

(1) It provides a boundary acting as either a source or receiver of liquid water; thus adequate "makeup" or "bleeding" is provided to assure maintenance—in the ideal case—of steady state conditions at the boundary with free transfer of mass either to-or-from the passing air stream.

(2) It establishes a pressure gradient between the boundary surface and the passing air stream thereby assuring mass flow in the desired direction.

(3) It sets up a temperature difference between surface and air stream to induce the transfer of sensible heat either to or from the air stream.

The above three determining characteristics represent separate parts of the transfer function, but they are closely interrelated and a change in any one will affect the rate of reaction of the other two. It is not essential, for example, that steady state exist at the wetted surface; in air washers (of the non-adiabatic type) steady state would very rarely occur, as the falling droplet would necessarily either receive or reject stored thermal energy during its passage from spray to basin; the drop temperature would accordingly increase or decrease. In washers having a large mass ratio of water flow to air flow (as some types of gas scrubbers) the transient change in droplet energy might be so small as compared with the mass that the temperature change of the droplet could be considered insignificant. With wetted transfer surface, as refrigerant-cooled coils with condensation occurring on the outside, there would be excellent opportunity for practically steady state conditions to exist.

In view of the indicated kinds of variation in operating conditions, it is evident that any one particular type of controlled-temperature wetted surface can not only vary greatly from others, but can likewise be subject to a wide range in variation with respect to its own designed performance characteristic. Thus such surfaces may closely approach steady-state performance or they may vary so greatly that the transient effects will overwhelmingly predominate. Fortunately, the influence of transience is primarily with respect to the quantitative rather than the qualitative performance of such a surface. An analysis based on the assumption of steady state will therefore more simply permit a rational interpretation of the actual surface and such an analysis will also provide a convenient starting place for the more precise quantitative evaluation, if this should subsequently be needed.

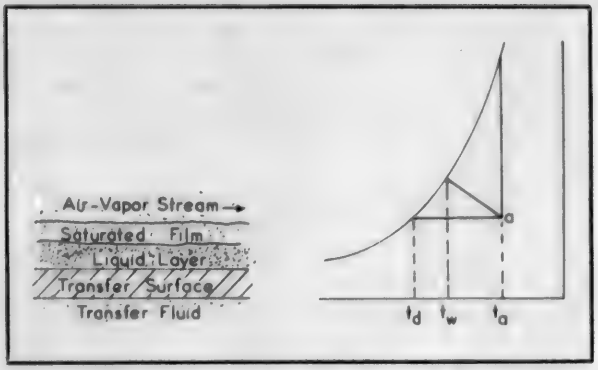

Fig. 1. Wetted surface under steady state conditions.

The Dynamic Transfer Surface

In subsequent sections the psychrometric review will provide detailed qualitative analysis of each of the seven critical operating conditions that occur with controlled-temperature surfaces. Before considering these special cases, however, it is desirable to examine a generalized wetted transfer surface and to visualize both the types of the processes and the process directions which can there occur. Fig. 1 represents an element of a controlled-temperature wetted surface which is considered to be acting under steady state conditions (that is, no variation in point-to-point temperature or humidity is occurring with respect to time; the state of the passing air stream varies with position, but not with time).

In this particular case a metal transfer surface sepa-

rates the passing air-vapor stream from a transfer fluid located beneath the surface; the transfer fluid can be either a refrigerant or a heating medium, the sole functional difference being that — if a heating medium — water would have to be supplied to the outside of the surface to make up for the rate of humidifying mass transfer from this surface. Adjacent to the exterior of the transfer surface is a thin layer of liquid water and exterior to this layer there will necessarily be a very thin stagnant layer—or film—of air saturated with steam at the approximate temperature of the liquid layer. Since the saturated vapor is at the approximate temperature of the liquid layer the vapor pressure which it exerts will be obtainable from tables of properties of steam as the saturation pressure corresponding to the liquid layer temperature. Note, therefore, that the vapor pressure exerted by the water molecules in the saturated film is entirely independent of the state of the passing air-vapor stream and is independently determined by the conditions, imposed from within, which exist at the steady-state wetted surface of the transfer member. (If the system consisted of a droplet of water the situation would be the same, the vapor pressure in the film then being determined by the temperature of the mass of water within the drop.)

The vapor pressure within the passing air-vapor stream is, from the psychrometric chart, determined as a fixed characteristic of its absolute humidity, which also determines its dew-point temperature. Thus if the dew-point temperature of the air-vapor exceeds the temperature of the transfer surface (regardless of the dry bulb or wet bulb temperatures of the air-vapor) there will exist a pressure gradient from the passing air stream in the direction of the wetted surface. In terms of the physical system, the initial tendency of vapor to flow from the main body of the passing air-vapor stream toward the transfer surface is strictly a mass-transfer phenomenon, due entirely to a pressure difference which is established by the fixed-temperature wetted surface. At this stage in the process the tendency toward drying of the air stream will be independent of heat transfer—either sensible or latent—and the sole driving force will be that due to difference in vapor pressure. Conversely, if the dew-point temperature of the air-vapor stream is less than the wetted surface temperature the vapor pressure gradient will be away from the surface and the initial tendency will be for vapor to flow from the saturated film out into the passing stream. As a final case, if the surface is maintained at the same temperature as the air-vapor dew point temperature, there will not be a pressure gradient, no tendency for mass flow will exist, and, for the initial condition, there would neither be a humidifying or a dehumidifying effect.

From these considerations it is evident that one and only one variable—temperature of the wetted surface—determines the initial impulse with respect to humidification or dehumidification. With dew point temperature of the air-vapor as a critical boundary both the direction and the magnitude of the initial mass transfer characteristic of the system are fixed in terms of surface temperature.

Returning now to Fig. 1, consider the dynamics of the system subsequent to the initial tendency toward mass transfer. Assume, for example, that the wetted surface is at a temperature greater than the dew point temperature of the air-vapor stream. As a result of the initial vapor pressure gradient, molecules from the saturated film will undergo mass transfer out into the stream. But reduction of molecular pressure within the film will change the film vapor from a saturated to a super-heated state and a tendency will then exist for evaporation to occur from the liquid layer into the unsaturated film. Evaporation, however, requires supplying the latent heat of vaporization to the mass of liquid which is undergoing phase change so it follows that this quantity of thermal energy must flow to the evaporating surface either from the transfer fluid back of the transfer surface or out of the air stream and inwardly through the saturated film. The direction of the transfer will obviously depend on the relationship between the temperature of the transfer fluid and the dry bulb temperature of the air-vapor stream.

Process Paths

In the operation of a wetted transfer surface there are thus five process paths which enter into determination of its performance:

(1) If humidification or dehumidification is occurring there must be a flow of liquid water from the liquid surface either to or from storage in a source or receiver (as a droplet) or to or from some external container.

(2) If humidification or dehumidification is occurring there must be a difference in vapor pressure to maintain the required transfer of mass to or from the evaporating surface.

(3) Accompanying the mass transfer will be an energy transfer of the latent heat of vaporization, this transfer occurring from the evaporating or condensing surface to or from the air stream by the mechanism of mass transfer rather than heat transfer.

(4) Sensible heat transmission may occur to the liquid surface either from the air-vapor stream or from the transfer fluid; this transfer can occur in either or both directions, the rate in each case being fixed by the conditions which govern conduction and convection.

(5) The net total heat transfer for the system can be in either direction and can equal either the sum or the difference of the sensible and latent heat fractions of the total. The mechanism of total heat transmission will, in general, be non-continuous since the latent fraction will approach a condensing surface by mass transfer and leave such a surface by conduction or convection whereas the sensible heat fraction will undergo transfer only by the mechanisms of conduction and convection. Obviously, therefore, analysis of the performance of a wetted surface will require separate consideration of the numerous separate and relatively independent thermal and mass paths which make up the combined process; under these circumstances it should not be surprising that wetted-surface conditioning units sometimes have experimental performance characteristics which disclose discontinuities that are difficult if not impossible to quantitatively interpret.

Critical Loading Conditions

In earlier discussion it was established that the relationship between wetted surface temperature and air-

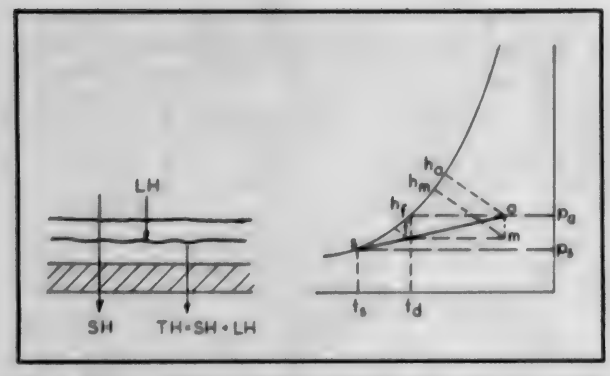

Fig. 2. Case 1. Wetted surface temperature lower than air-vapor dewpoint, LH = latent heat; SH = sensible heat; TH = total heat.

vapor temperature determines whether the air stream is being humidified or dehumidified; in another sense this relationship can be said to fix the direction and the magnitude of the latent heat transfer—assuming that any such transfer is taking place. Similarly, the relationship between wetted surface temperature and wet bulb temperature of the air-vapor stream fixes the direction and magnitude of total heat transfer to or from the system. Lastly, the dry bulb temperature, wetted surface temperature relationship fixes the direction and magnitude of the sensible fraction of heat transfer. In addition to the three critical boundary conditions which these three psychrometric temperatures determine there are four regions on the psychrometric chart, bounded on one or on both sides by the psychrometric temperatures, in which wetted surface performance maintains continuity with respect to all five of the process paths. Thus the four regions plus the three fixed temperature lines establish seven critical loading conditions each of which is characterized by a unique, and qualitatively unchanging, relationship among the directional relationships for mass transfer, sensible heat transfer, latent heat transfer, and total heat transfer.

In spite of their inherent consistency the five critical loading conditions include some external conditions which, at first glance, seem strange or unlikely. Thus refrigeration may be required (that is, total heat flow from the system) for certain conditions of either humidification or dehumidification and, conversely, heating may be necessary even when the object of the conditioning is, in part, to reduce the temperature of the air-vapor stream. Each of the seven critical loading conditions will now be given separate consideration.

Case 1: The Wetted Surface Temperature is Lower than the Dew Point Temperature of the Passing Air-Vapor Stream. Fig. 2 shows a psychrometric representation of this critical loading condition and indicates the directions of the various transfer processes. The wetted-surface temperature, t_s, (refer to Fig. 2) is less than the dew point temperature by an amount t_d-t_s, hence this gradient, acting through the saturated film, the liquid layer, and the transfer surface tends to maintain a transfer of sensible heat from the passing air-vapor stream to the transfer fluid back of the transfer surface. The vapor pressure in the air-vapor stream is p_a whereas the vapor pressure in the saturated film is less by an amount p_a-p_s; this difference maintains mass transfer of vapor from the air-vapor stream toward the saturated film. But the vapor pressure within the film cannot exceed its saturation value at film temperature, hence as water molecules enter the film condensation must occur with maintenance of fixed vapor pressure and liberation of the latent heat of vaporization. The latent heat is carried into the film by mass transfer, is there converted to sensible heat during the process of phase change and subsequently flows by convection and conduction through the transfer surface and through the liquid film on the opposite side of the transfer surface. The total heat transfer from liquid layer through to transfer fluid occurs by the mechanisms of heat transmission and is equal to the total of the sensible and latent heat loads which are delivered to the saturated film. Note, therefore, that temperature difference from air-vapor stream to saturated layer controls the rate of sensible cooling only, whereas the temperature difference from liquid layer to transfer fluid must be sufficient to transfer the sensible and latent heat loads at those rates which correspond to equilibrium steady-state conditions for the system.

The final state of the passing air-vapor stream will be at some point, as *f* in Fig. 2, approximately on the straight line connecting the initial stream state, *a*, and the state, *s*, of the saturated film. The heat loads (from the psychrometric sketch in Fig. 2) will then be equal to the enthalpy difference (h_a-h_m) for latent load in Btu per pound of dry air, the enthalpy difference (h_m-h_f) for sensible load in Btu per pound of dry air, and the sum of these enthalpy differences, or (h_a-h_f) for the total heat load expressed in the same units.

The system as a whole will operate to provide cooling with dehumidification and its connection with the external environment will necessitate refrigeration (or some other means of heat extraction) together with a discard receiver for the liquid water extracted from the air-vapor mixture.

Case 2: The Wetted Surface Temperature is Equal to the Dew Point Temperature of the Passing Air-Vapor Stream. The psychrometric and transfer surface representations of this case are illustrated in Fig. 3. Since the dew point and wetted surfaces temperatures are equal it follows that there will not be a pressure gradient between the air-vapor stream and the transfer surface (p_a=p_s). In consequence the thermal performance of the wetted surface will be exactly the same as that of a dry surface except that the presence of the liquid layer will provide slight added thermal resistance to heat transfer and may

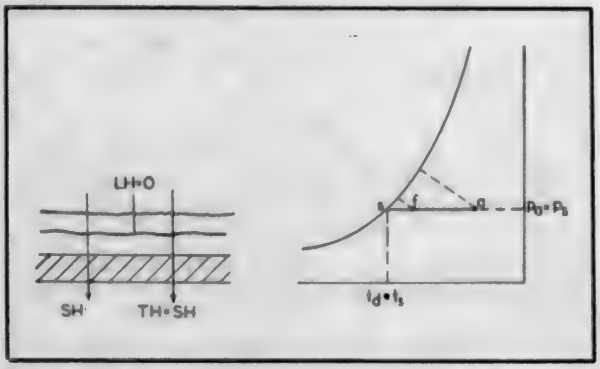

Fig. 3. Case 2. Wetted surface temperature equal to air-vapor dewpoint.

alter the value of the film coefficient of heat transfer on the outer side of the transfer surface. The psychrometric process will be one of simple cooling along the line *a*——*s* to some intermediate point (determined by the by-pass factor of the particular equipment) as *f*. If transfer coils were used, it is evident that there would be no reason for keeping the surface wetted, but the visualization at left of Fig. 3 does closely correspond to that which would exist in an air washer where the ratio of water-to-air mass flow rate was high and the droplets therefore underwent inappreciable temperature change; in such a case cooling coils or other means would be needed to extract heat from the droplets prior to each return to the sprays.

The rate of heat extraction for this system would then be the enhalpy difference (h_a-h_f), this value being equal to both sensible and total loads. Rate of heat extraction could also be calculated as the product of the humid specific heat of the air-vapor stream at the known dew point temperature multiplied by (t_a-t_f).

Case 3: The Wetted Surface Temperature is Greater than the Dew Point Temperature but Less than the Wet Bulb Temperature of the Passing Air-Vapor Stream. In this case (refer to Fig. 4) a vapor pressure gradient

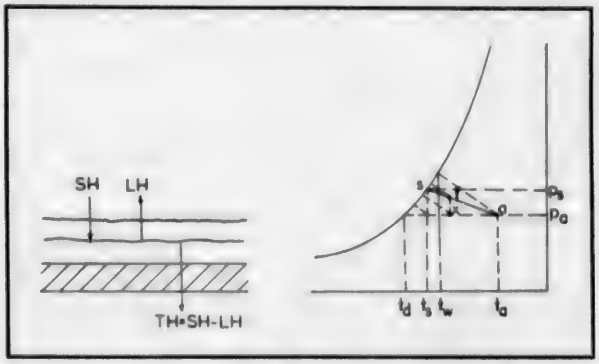

Fig. 4. Case 3. Wetted surface temperature greater than air-vapor dewpoint but less than air-vapor wet bulb.

(p_s—p_a) *tends* to establish mass transfer from the saturated film out to the passing stream while a temperature gradient (t_a—t_s) acts in the opposite direction to provide sensible cooling of the air-vapor stream. Since the final state of the stream, at *f* along line *a*—*s*, is one for which the enthalpy, h_f, is lower than the initial value, h_a, it follows that the cooling effect on the air-vapor stream provides a source of energy at the liquid surface which exceeds the amount needed to supply the latent heat of vaporization. In effect heat transfer brings thermal energy from the stream to the liquid surface where a substantial portion is converted to latent heat and returned by mass transfer to the air stream; the excess of transferred sensible cooling is then dissipated as the total heat transfer (equal to sensible transfer from air minus latent transfer to air) to the transfer fluid and hence from the system.

With Case 3, as with the two previous cases, refrigeration or other cooling effect is required, but the accompanying change in state of the air-vapor stream involves simple cooling combined with humidification. The sensible load is (h_a-h_s) Btu per lb of dry air, the latent heat load is (h_f-h_s) Btu per lb and the total heat load is the difference between the two or (h_a-h_f) Btu per lb.

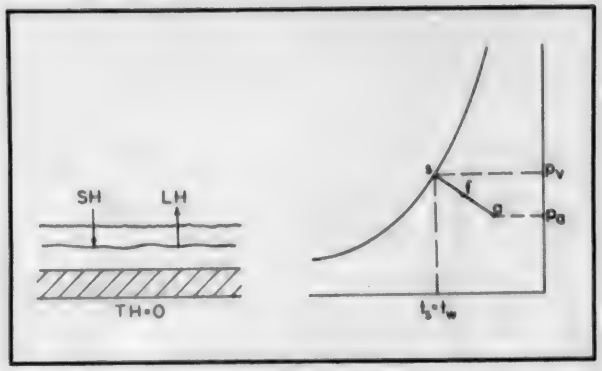

Fig. 5. Case 4. Wetted surface temperature equal to air-vapor wet bulb.

Case 4: The Wetted Surface Temperature is Equal to the Wet Bulb Temperature of the Passing Air-Vapor Stream. This case, corresponding approximately to operation under adiabatic conditions, is commonly used in many types of air conditioning equipments such as adiabatic air washers and unit-type evaporative coolers. As shown in Fig. 5, a vapor pressure gradient (p_s-p_a) establishes mass transfer from the saturated film out to the passing stream whereas a temperature gradient in the opposite direction (t_a-t_s) establishes a flow of sensible heat from the air-vapor mixture to the liquid layer. For all practical purposes the rate of sensible transfer is equal to the latent heat requirements, hence neither the total heat content of the air-vapor mixture nor of the system as a whole undergoes appreciable change.

In two minor respects an exact balance is not obtained:

(1) Assuming that make-up water to the wetted surface enters at the wet bulb temperature of the air-vapor stream, it follows that this make-up brings into the system an amount of external energy equal to the heat of the liquid; this amount is small for normal temperatures, but can be corrected for by using a corrected process line for constancy of the sigma heat content rather than constancy of enthalpy (sigma heat content being defined as enthalpy less the heat of the associated liquid between the wet bulb temperature at any state and 32 F).

(2) Precise experimentation has shown that the true temperature of adiabatic saturation differs slightly from the wet bulb temperature; the difference is due to departure from unity of the ratio of thermal film resistance to mass transfer film resistance, but is not of engineering significance for temperatures lower than 120 F.

When, as usually occurs, the make-up water is supplied to the unit at some temperature other than the wet bulb temperature of the air-vapor mixture there will be a transient interval corresponding to operation as in either Case 3 or Case 5 (depending on whether the make-up water is too cool or too warm) during which the system will operate non-adiabatically and the water temperature —during repetitious passage through the sprays—will be altered until it is practically equal to the wet bulb temperature of the entering air-vapor stream.

Case 5: The Wetted Surface Temperature is Greater than the Wet Bulb Temperature but Less than the Dry Bulb Temperature of the Passing Air-Vapor Stream. As the wetted surface temperature increases through the psychrometric region covered by this case the required

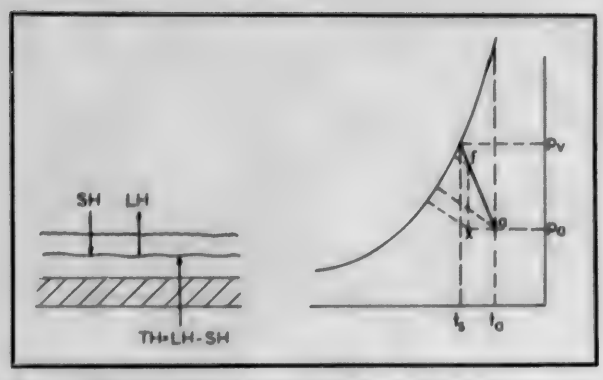

Fig. 6. Case 5. Wetted surface temperature greater than wet bulb but less than dry bulb of air-vapor stream.

total heat flow to the system increases, the degree of humidification increases, and the sensible cooling effect decreases. As shown in Fig. 6 the temperature gradient (t_a-t_s) establishes convective transfer from air-vapor stream to liquid surface while the opposite pressure gradient (p_s-p_a) brings about a large humidification rate with correspondingly large mass transfer and latent heat transfer from the saturated film out into the stream. Latent heat requirements exceed the energy which reaches the liquid surface as a result of sensible cooling, hence a make-up of sensible heat for conversion to latent heat must be supplied through the transfer surface from the transfer fluid. The change occurring due to passage of the system from the region of Case 3 to that of Case 5 is a change from a refrigeration (or other cooling) system to a heating system even though the net effect of the heat source which is external to the transfer surface is to reduce the temperature of the air-vapor stream rather than to raise it.

The required latent heat transfer amounts to (h_f-h_a) Btu per lb dry air, the sensible heat load is (h_a-h_s) Btu per lb and the total heat load—equal to the required heating effect—is the difference or (h_f-h_a) Btu per lb.

In Case 5 it is interesting to note that the minimum temperature of the system must occur at the interface between the liquid layer and the saturated vapor film, since sensible heat is flowing to this interface from both directions; note, therefore, that the temperature difference between the transfer fluid and the air-vapor stream does not have significance in terms of rate of heat transmission since it is not numerically equal to a temperature gradient, but rather to the algebraic sum of two gradients which act in opposite directions. This fact clearly demonstrates the care that must be taken in interpreting temperature differences in terms of heat transfer rates. With wetted surfaces the overall temperature difference rarely has overall significance; heat transfer rates depend only on the temperature difference operative over the actual process path which is in question.

Case 6: The Wetted Surface Temperature is Equal to the Dry Bulb Temperature of the Passing Air-Vapor Stream. For this limiting case (refer to Fig. 7) the interface between the liquid layer and the saturated film becomes the division line between two regions, in one of which there is mass transfer but not heat transfer, and in the other heat transfer without mass transfer. The system becomes one of simple humidification (no change in temperature of the humidified air-vapor mixture), the necessary latent heat of vaporization being derived wholly from an external heat source. Referring to the sketch at left in Fig. 7, the total heat gain is equal to the latent heat gain, (h_f-h_a) Btu per lb dry air, and is transferred across the film of the transfer fluid, through the transfer wall, and through the liquid layer by the mechanisms of conduction and convection. In this connection note particularly that a temperature gradient must exist from the transfer fluid to the surface of the liquid layer, the magnitude of this necessary gradient being determined by the rate at which humidification is to occur; examination of Fig. 7 does not provide information which will permit either recognition of the gradient or evaluation of its magnitude.

In all of the cases which have been considered where humidification is occurring (Cases 3, 4, 5 and 6) the final indicated state, *f*, has been below the saturation line. This means that the temperature of the vapor in the leaving air-vapor stream exceeds the saturation value corresponding to its vapor pressure, hence the vapor must be in a superheated state. In passing from the saturated state within the film to the superheated state within the air-vapor stream the vapor pressure necessarily decreases, the heat of the liquid (at saturation pressure) decreases, the latent heat of vaporization increases, and the energy present due to superheat increases; the enthalpy of the superheated vapor increases slightly from the enthalpy of the higher pressure saturated vapor. (This condition follows from examination of the psychrometric chart since low pressure vapor acts essentially the same as a perfect gas and its enthalpy is therefore practically constant along the vertical isothermals).

Case 7: The Wetted Surface Temperature Exceeds the Dry Bulb Temperature of the Passing Air-Vapor Stream. This case (Fig. 8) represents transition across the last of the psychrometric boundaries. It is similar to Case 1 in that sensible heat, latent heat, and total heat are all flowing in the same direction, but is the opposite of Case 1 in that the effect is to heat and humidify the air-vapor stream rather than to cool and dehumidify it. Heat transfer brings the total heat from the transfer fluid through to the interface between the liquid layer and the saturated film. At this interface the total heat splits, the latent fraction being utilized in achieving phase change and then passing—under mass transfer—out to the air-vapor stream, whereas the sensible fraction continues outward

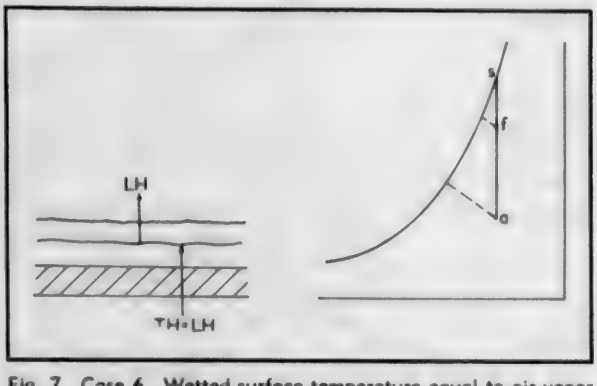

Fig. 7. Case 6. Wetted surface temperature equal to air-vapor dry bulb.

by convection to provide a temperature rise in the air-vapor stream. Note that while a continuous temperature drop must occur from a high in the transfer fluid to a low in the air-vapor stream this temperature drop consists of two independent, series-connected gradients; the inner gradient determines rate of total heat transfer, but the outer gradient is effective only with respect to the transfer of the sensible heat load.

Limitations of the Wetted Surface

The seven psychrometric cases which have been considered include conditioning air within three of the four psychrometric quadrants: (1) Cooling and dehumidifying; (2) cooling and humidifying; (3) heating and humidifying. The fourth quadrant (heating and dehumidifying) cannot be reached through use of the controlled-temperature wetted surface, but it should also be noted that neither does such a surface provide complete coverage of the other three quadrants. Referring to Fig. 9, let *a* be the state of air which is to be conditioned. The lower limit of a process line along which air at state *a*

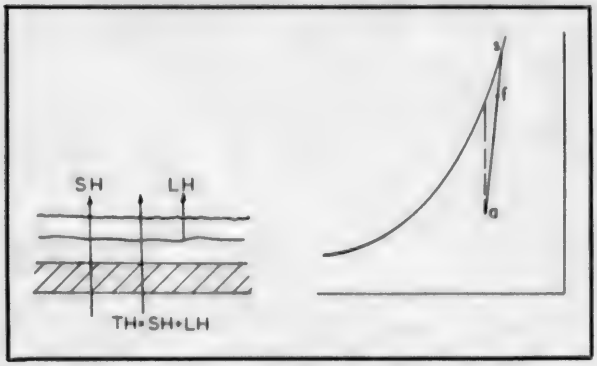

Fig. 8. Case 7. Wetted surface temperature greater than air-vapor dry bulb.

could be conditioned would be the line *a*——*c* drawn through *a* and extending to tangency with the lower temperature section of the saturation line. A wetted surface at any temperature lower than t_c would not operate by the procedures discussed because the line *a*——*c* would then cross the saturation line and partially extend through the fog and mist region which exists upward and to the left of the saturation line.

The upper limit of a process line through state *a* would be *a*——*b*, tangent to the saturation line at point *b*. Thus the entire shaded region below and to the right of *cab* represents a region on the psychrometric chart to which air at state *a* could not be conditioned by a wetted surface.

Further, the excluded region is evidently a variable in terms of the location of the state of the initial air-vapor stream. Thus if state *a* moved left and upward to a new location at *a'* it is evident (from Fig. 9) that there would be an additional reduction of possible conditioned states through elimination of the previously possible area bounded by acc'a'b'ba. Thus, useful though a wetted surface is, it is nonetheless subject to limitations of application in practical air conditioning problems. Further, economic disadvantages (such as the possible requirement of an excessively low evaporator temperature to maintain

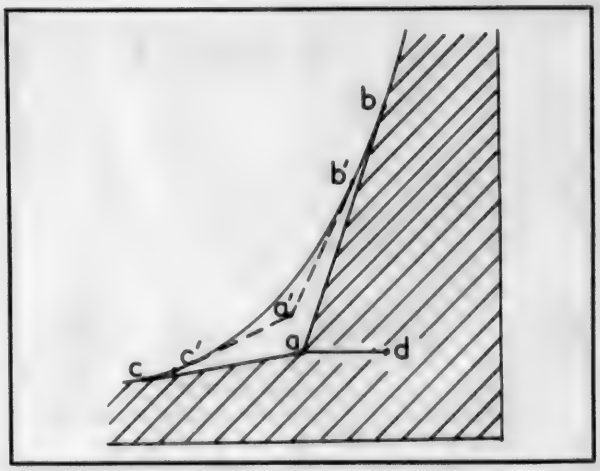

Fig. 9. Wetted surface cannot change state of air at **a** to any point in shaded area.

coil surface at a temperature well below that of the conditioned air) often act to the disadvantage of the wetted coil. When combined in series with a preceding simple (dry) heating coil, the range of the wetted coil can be very greatly extended. Again referring to Fig. 9 note that a simple heating coil could readily change state *a* to a new state *d* from which the wetted surface would be able to reach a substantial fraction of the psychrometric area that is cross-hatched with respect to operation from state *a*.

Summary

Of all principles used by engineers to heat, cool, humidify, or dehumidifying an atmospheric environment it is almost certain that the controlled-temperature wetted-surface is the most versatile. The principle involved in the use of such a surface recognizes that many air conditioning problems require the simultaneous transfer of both mass and thermal energy, sometimes the transfers taking place in the same direction and at other times in opposite directions. A wetted surface, whether the actual liquid boundary of a droplet or the moistened surface of a metal heat transfer plate, provides the dynamic plane at which conversions occur from sensible to latent heat—and vice versa—and changes of "transportation" occur as energy either flows as heat or is carried as latent heat.

A qualitative investigation of the working characteristics of wetted surfaces is valuable to the engineer in assisting him to visualize the mechanisms of heat transfer and of mass transfer and in providing recognition of the boundaries between the two. Seven critical loading conditions are analyzed and the typical performance of a wetted surface for each of these conditions is fractionated into regions of latent heat transfer, sensible heat transfer, and total heat transfer; such an analysis permits recognition of the regions where a gradient of vapor pressure is the major controlling factor in contrast with other regions where temperature gradient controls the rate of reaction.

The principles discussed are equally applicable to the qualitative understanding of the performance of air washers, gas scrubbers, cooling towers, spray ponds, evaporative coolers (or condensers), and wetted coils or transfer plates.

Flash Tank Design

T. W. REYNOLDS

The author shows how to select a flash tank for a given service and comments on the steam separating action in the tank with reference to tank design.

FOR many years the writer has searched for information on the design of flash tanks. What little was found gave no complete procedure, but did give some surprising results when one attempted to design a tank on the given basis. The usual approach is one more of theory than of fact. When one is groping around for a formula, the action within a boiler or steam accumulator is seized upon as a comparable design situation, and a formula soon is developed which being but a formula, diverts the mind from plain thinking and ordinary observation. A fact frequently overlooked is that most of the flash in a tank is due to mechanical separation rather than to any particular ratio of steam disengagement area, pressure, or velocity of steam selected.

In a previous article (H&V, April, 1950) the writer presented various factors affecting the design of flash tanks. These were worked out backward from capacities of commercial flash tanks used in the continuous blow down process by the Cochrane Corporation. Long experience has proven that the given capacities provide good separation of steam from the water. Thus, as often happens, a record proves a better anchorage than any formula. In any event, the writer again makes use of these capacities, although presented this time in an entirely different and more convenient manner by tabulated capacities referred directly to commercial tank sizes. Some new reasoning is presented to promote a more rational procedure than has previously prevailed.

Not very much may need to be said about the tables as these are arranged for self explanation and are simple to use. For example, with 6,000 lbs of condensate per hour at 400 psig boiler pressure entering, a flash tank maintained at a flash pressure of 5 psig, the percentage of steam flashed (see Table 1) is 25% or 1,500 lb per hour at 5 psig. From Table 2, the tank selected would be No. 1 if the tangential type and No. 2 if of the top inlet type. Dimensions of the tanks are given in Table 3. With the tangential type there is provided within the tank a spiral channel to direct the unflashed condensate. On the basis of the same guarantee of moisture content in the flashed steam, this type of tank can be made somewhat smaller than the top inlet design.

The condensate at 400 psig with a heat of the liquid of 428 Btu flashes to the lower pressure of 5 psig which has a heat of the liquid of 195 Btu and a latent heat of 960 Btu. Therefore 428–195=233 Btu, the excess heat at 5 psig which will flash, or 233/960 equal to 25% of the condensate flashed as per Table 1.

The statement is sometimes made that the pounds of flash steam per square foot of water surface per hour is equal to three times the absolute pressure on the water. This conclusion is based on the action within a storage tank known as a steam accumulator which contains water at saturation temperature to store heat and to generate steam by flashing as the pressure of the water is reduced.

This rule of three times absolute pressure times area for the pounds of flash steam per hour is suggested by one writer as a means of setting the upper limit of tank size. while for the lower limit a suggested criterion is that velocity of steam leaving the area which will not carry drops of water away. Accordingly, he presents a table limiting steam velocities from the disengaging area for various sizes of water droplets. The smallest listed particle size of .005 inch is then recommended as a limiting small size which will require that steam velocities be lowered to where the force exerted on the drops will be too low to carry them away. A further suggestion is then made that the designer select a cross sectional area of tank which will be somewhat between the upper and lower limits of the two methods.

Unfortunately, the spread within the given limits is so great that each designer would no doubt obtain a far different answer. The first method gives areas around ten times as great as those listed for tanks of the top inlet type (See Table 2). As for the tangential inlet type, no comparison is in order, because this type of tank is too efficient as a mechanical separator for fair comparison with usual separating or flash tanks.

The second method, although a good approach, gives areas which are approximately correct for tanks with flash pressure of 10 psig, but from this pressure up to 50 psig the given areas gradually increase to well over twice as great as those listed in Table 2 for tanks of the top inlet type. The particle size of .005 inch referred to is listed by the one mentioned for flash tank pressures of 0, 10, 20, 30, 40 and 50 psig with corresponding steam velocities in feet per second of 5.7, 3.5, 2.6, 2.0, 1.7 and

TABLE 1.—FLASHED STEAM IN PERCENTAGE

Boiler Pressure Psig	Flash Tank Pressure—Psig										
	0	5	10	20	30	40	50	75	100	125	150
	Percent of Water Flashed										
50	9	8	6	4	3	2	0	0	0	0	0
75	11	10	8	6	5	4	2	0	0	0	0
100	13	12	10	8	7	6	4	2	0	0	0
125	15	14	12	10	8	7	6	4	2	0	0
150	17	15	13	12	10	9	8	6	4	2	0
200	19	18	16	14	13	12	11	8	6	4	3
250	21	20	18	16	15	14	13	10	8	7	5
300	23	22	20	18	17	16	14	12	10	8	7
350	24	23	22	20	18	17	16	14	12	10	8
400	26	25	23	22	20	19	18	15	14	12	10
450	27	26	24	23	21	20	19	16	15	14	12
500	28	27	26	24	23	22	21	18	17	15	14
600	31	29	28	27	25	24	23	20	19	17	16

TABLE 2.—MAXIMUM FLASH STEAM RATING

No.	Flash Tank Pressure, Psig										
	1	2	5	10	20	30	40	50	75	100	150
	Maximum Rating, Lb per Hr for Tangential Inlet Flash Tanks										
1	1,500	1,600	1,800	2,300	3,000	3,900	4,800	5,500	7,500	9,500	13,000
2	2,600	2,700	3,100	3,900	5,100	6,800	8,000	9,500	12,900	16,000	22,000
3	4,000	4,200	5,000	6,000	8,000	10,200	12,000	14,500	20,000	25,000	35,000
4	6,000	6,100	7,100	8,800	12,000	15,000	18,000	21,000	27,000	34,000	50,000
5	10,000	10,500	12,500	15,000	21,000	26,000	31,000	38,000	50,000	64,000	91,000
6	16,000	17,000	20,000	24,000	32,000	41,000	49,000	58,000	79,000	100,000	142,000
7	23,000	24,000	28,000	33,000	46,000	57,000	68,000	80,000	110,000	139,000	196,000
8	27,000	29,000	34,000	42,000	58,000	73,000	89,000	105,000	142,000	180,000	254,000
	Top Inlet Flash Tanks										
1	1,100	1,160	1,320	1,700	2,200	2,800	3,400	4,000	5,500	6,900	10,000
2	1,800	2,000	2,300	2,800	3,900	4,900	5,900	6,900	9,400	11,800	17,000
3	2,900	3,100	3,700	4,500	6,000	7,600	9,200	10,800	14,500	18,000	25,000
4	4,300	4,600	5,200	6,500	8,700	10,800	12,900	15,000	20,000	25,000	36,000

1.4. This listing presumes that the particle size remains constant at all pressures, which seems doubtful.

Steam velocities at the foregoing pressures, if worked out from the quantities of steam flashed in Table 2 for tanks of the top inlet type, would vary from about 2.5 to 2.3 ft per second, decreasing as the pressure increases. With tanks of the tangential inlet type, in the same table, the velocities would be around 3.3 ft per second, since such types of tanks with better mechanical separation provide less carry over. They are designed and sized on the basis of a large ratio of water to steam. Considerably more water will be evaporated from all flashing water particles as they separate and splash in their fall from tank inlet to water level in the tank.

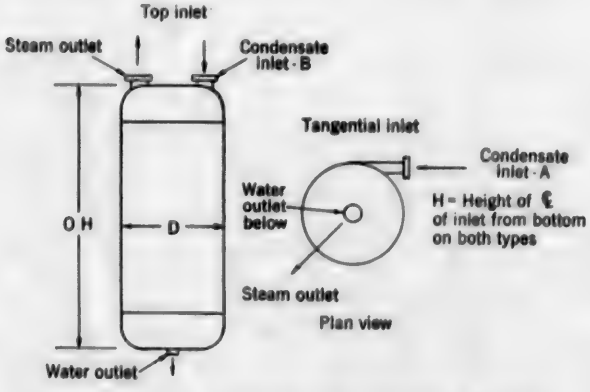

Fig. 1. Flash tank dimensions with reference to Table 3.

TABLE 3.—DIMENSIONS OF COMMERCIAL FLASH TANKS
(With reference to Fig. 1)

Tank No.		Diameter D	Height OH	Height H	Connection Diameter, Inches			
					Inlet		Outlet	
Top Inlet	Tangential Inlet				A	B	Steam	Water
		Feet and inches						
1	1	2-0	4-3	3-10	1½	3	3	1½
2	2	2-8	5-6	4-11	2	4	4	2
3	3	3-4	6-8	6-1	2½	5	5	3
4	4	4-0	7-10	7-0	3	6	6	4
Not made*	5	4-6	8-2	7-2	4		8	4
	6	5-0	8-6	7-6	6		10	6
	7	5-6	8-9	7-6	6		12	6
	8	6-0	9-0	7-7	8		14	6

*Use tangential inlet type.
Do not interpolate for any size but use next larger size.

The most important disengaging area in a flash tank is, therefore, mainly within the vertical flow of water within the tank, as well as within the entire length of the return piping connected to the tank. Hence, the full extent of disengaging area will always be an unknown factor of flash tank design. By the time the condensate has reached the storage section of the tank, practically all, if not all, of the condensate has lost its flashed steam.

In the case of a conventional flash tank, flashing actually starts at the point of throttling, that is, at the point where the rate of flow is restricted so as to effect an appreciable pressure reduction and consequent generation of steam by flashing. The amount of flash steam formed in the return line to the separating tank is governed by the pressure drop in that line and flashing progresses by natural action until actual release of the condensate and flashed steam into the tank.

If all of the flashing took place in the flash tank, the pressure in the condensate line would be the same at the tank entry as it would be far back at the point of throttling. Observation of pressure gages on actual installations does not show the same pressure throughout. Considerable work has been done on the subject of pressure drop and carrying capacity of pipes conducting flashing mixtures. Due to this one characteristic alone, such pipe lines make quite effective self regulating controls of their own drainage. Pipe lines carrying flashing mixtures, when of appreciable length and not rigidly supported, demonstrate the flashing action by frequent violent vibrations.

For maximum separating efficiency, or more properly for comparable separating efficiency, the velocity of vapor must be decreased with increased pressure. Per unit of evaporation per unit area, there is more tendency to carry over as the pressure increases. Notice that while the ratings in pounds per hour increase with increasing tank pressure, in Table 2, the steam volumes (hence steam velocities) actually decrease with increasing pressure.

Frost Closure of Roof Vents in Plumbing Systems

In the northern part of this country and in Canada, plumbing system roof vents sometimes become partially or completely closed by frost accumulating during very cold weather. Various practical expedients for preventing this phenomenon have been tried, some of which have been successful. For example, some plumbing codes specify a 4-inch minimum diameter for the exposed portion of a roof vent. However, no scientific method for predicting the extent of frost closure under given conditions appears to have been developed until H. N. Eaton and R. S. Wyly of the National Bureau of Standards conducted an investigation of this problem. The study was sponsored in part by the Housing and Home Finance Agency.

THE principal objection to frost closure of plumbing vents is the fact that air flow into the vent cannot completely replace the air that is carried down the drainage stack and out of the plumbing system when water is discharged from the fixtures. If the roof vent is nearly or completely closed, the discharge of a single water closet will often suffice to siphon the water seals from one or more fixture traps on the system, thereby making it possible for sewer atmosphere to enter the rooms of the building in which the plumbing system is located.

Frost closure occurs naturally in two forms: (1) a cylindrical layer of frost on the inside of the exposed portion of the vent pipe extending above the roof, and (2) a frost cap at the top of the vent. The two forms may occur simultaneously.

It has been commonly believed that if the weather is cold enough to initiate the process of frost closure in a vent of any diameter and that if these conditions persist for a sufficiently long period, the vent will become completely closed, but this is not always true. Actually, under some conditions a layer of ice or frost forms on the wall of the vent and increases in thickness up to a certain maximum value, depending on the diameter of the vent and on the rate at which heat is extracted from the air stream through the wall of the vent. This thickness may or may not be sufficient to close the vent.

By applying heat transfer analysis to a set of assumed conditions, it is possible to compute the temperature of the ice-air surface as the vent freezes. As shown in Fig. 1, for a 4-inch metal vent, a wind velocity of 10 ft per sec across the roof, an air stream temperature in the vent of 60 deg F, and an outside air temperature of less than about 7 F, the vent will freeze solid, but for outside temperatures greater than about 7 F it will not. For example, if the outside temperature is 10 F, the computations indicate that freezing will stop when the diameter of the opening is reduced to about 0.63 of its original value, while for an outside air temperature of 20 F no reduction whatever will take place. Although the analysis indicates the controlling conditions and the extent of frost closure, it does not show the length of time required to close the vent opening to any particular size.

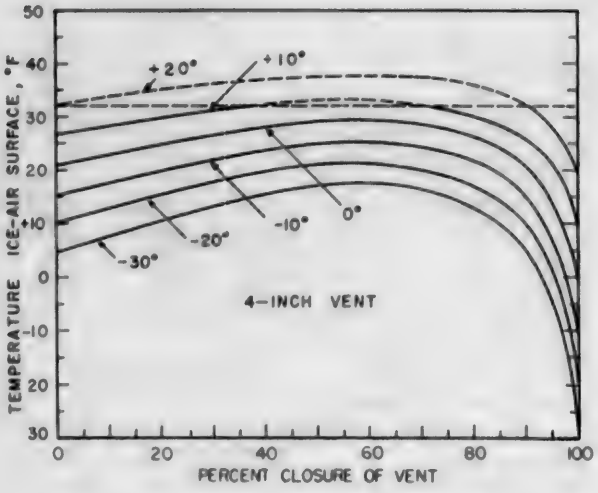

Fig. 1. By means of a heat-transfer analysis carried out at NBS, it is possible to compute the temperature of the ice-air surface as the vent freezes up for any assumed conditions. This graph shows the results of this computation for a 4-inch metal vent, when the wind velocity is 10 fps across the roof and the air stream temperature in the vent is 60 F. For an outside temperature of less than 7 F, the vent will freeze solid; for higher outside temperatures, it will not. The numbers on the curves indicate outside air temperatures. The percentage of closure on the horizontal scale is expressed in terms of diameter.

Frost closure has been produced experimentally in the Bureau laboratories. Roof vents of several different diameters were extended up into a chamber in which temperatures as low as –30 F were maintained, and warm moist air was blown up through the drainage stack and roof vent to simulate the conditions that cause frost closure in actual service. Periods in excess of 9 hours were generally required to close 1½-inch vents exposed to a temperature of –30 F, and increasing the diameter of the vent or decreasing the length of vent exposed to the low temperature increased the time required for effecting complete closure.

Recorded observations of frost closure under service conditions in Canada for 6- and 8-inch vents were found to agree rather closely with the predictions of the Bureau's analysis. The Canadian field data are limited in scope and some of the conditions which may have determined the results are not known; therefore these data probably do not provide a sound basis for judging the degree of accuracy of predictions made by theoretical means. However these data indicate that the method used in the analysis should give an approximation of the extent of frost closure in service under various conditions. The study also indicates the desirability of keeping the extension of the vent above the roof as short as practicable, of increasing the diameter of the roof vent one or two sizes over the diameter of the stack, and of using insulating materials around the roof vent in areas where extremely cold weather may be expected.

Safe Disposal Methods for Liquid Industrial Wastes

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Industrial plants, particularly those employing a chemical or washing process, discharge large amounts of liquid waste which must be so treated that these wastes will not be a polluting factor when discharged into streams, or become a special burden when directed into a municipal sewage treatment plant. Many factors must be considered in evaluating the best location for a plant to handle liquid industrial waste and in choosing the best type of treatment. This article is intended to provide a basic understanding of the problem and the various methods available for treating the waste. This overall picture of industrial waste treatment is provided, because of the large amount of pipe used in these systems, and the attractive field it offers to the piping designer and to the large piping contractor.

Safe Disposal Methods for Liquid Industrial Wastes

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ONE of the most serious problems facing industry today is the disposal of liquid wastes from the many manufacturing and processing plants. This problem is more intense in sections of greater industrialization than in others, particularly in areas distant from the coast and where streams are small.

This situation has existed since the opening of the first industrial plant in the United States which discharged a liquid waste containing elements that created pollution of the receiving streams. But until comparatively recent years, when populations centered around certain points or along certain streams, and depended for their potable water supplies on these same streams, little or nothing was done to correct this situation.

With (1) the constantly increasing use of water for both human and industrial purposes and (2) the denudation of the land resulting in heavy flash floods instead of the gradual and continuing run-off of earlier years, the water in the streams of the country has been called upon to do double duty:

(1) To supply the needs of the contiguous municipalities.

(2) For the use by industries.

This has created the problem of installing expensive water treatment plants as the pollution in the streams increased. It required that more complex water treatment processes be developed and used to restore water to its original state of safety and purity.

Rights to Streams

Legally, users of a stream have a prescriptive right to use the water from that stream, but it also obligates these users to return the water to the stream in "the same volume and condition as when it was taken from it."

Industry has an obligation to the people to endeavor to follow this precept of law as much as possible. Industry creates the wastes, and it is only natural that industry should, in the main, be expected to assume the cost of so disposing or treating the wastes that the streams, lakes and other waters of the country shall not be rendered useless as sources of the essential water for humans or for their recreation.

Along with this obligation, which is permeating today's industrial thinking, is the fact that disposal or treatment of wastes is usually an expense divorced from hopes of substantial remunerative recovery. In a democratic state, industry is privately owned, and therefore, the owners do not receive with enthusiasm operations which will increase their production costs and lessen their profits. This is particularly true in a competitive economy such as one finds exists in all branches of American industry today.

However, due to the appalling pollution of our streams and water courses, the governments of our States and of the United States itself, have had to promulgate laws and regulations to curtail and prevent this continued contamination of these waters. In the past few years, this has had a tremendous impact on the consciousness of industry towards its obligation to the people of the country and to their fellow producers.

Where an industry produces a liquid discharge from its plant that would, if permitted to enter a local stream or body of water, seriously pollute that stream with consequent danger to public health or comfort, that waste is not always discharged to such a stream. In many cases, where the wastes can be taken into the local sewerage system and handled by it, the problem then is one of disposal. Local authorities become responsible for the ultimate waste discharge. If the industry pays the municipality in some form or other for this handling, it may be a ready solution of their problem. On the other hand, if the industry cannot enter the local system, because of the character of the wastes, the capacity of the local plant, or for any other reason, then industry must consider means to so treat its discharges that they may enter a local stream without danger of pollution. This is *treatment*, and the discharge of the effluent after treatment to the stream, is *disposal*. Let us keep in mind the distinction between these two things.

Not all liquid discharges from industrial plants will cause pollution. The cooling waters used in many plants, which are not contaminated by any toxic or putrescible ingredient, may frequently, and usually are discharged directly into the stream or sewer system, or in many cases are reused for the same purpose after cooling.

What Constitutes Pollution

Any substance contained in a liquid discharge from any industry or community is considered a pollutant, if it will (1) reduce the oxygen content of the receiving water; (2) will add toxic ingredients to it that are harmful to the human body; (3) will tend to cause obnoxious accumulations of decomposing materials; (4) may cause floating scums or sleeks, rendering the water unpleasant to eye or nose; (5) will render the water unsafe for human or animal consumption without expensive treatment; (6) will render the stream incapable of supporting fish life; or (7) will, in any way, render the stream unsafe for any of its normal uses.

In some states, where certain industries are concentrated on certain streams which are the logical discharge points for the wastes of those industries, and the streams are not normally used as sources of potable water supplies, then these streams may be classified in such a way that wastes may be discharged into them with a limited degree of treatment. This will lighten waste-treatment expense to industries. Such streams, usually those discharging into the sea or into very large bodies of water, frequently are and continue to be polluted. In many states, it is the custom today to classify all the streams of the state according to their ability to receive industrial wastes, and in what degree. This is a very sensible and logical procedure and is a recognition of the great part that industry plays in the American scene.

Conflicting Interests

In recent years it has also been necessary to decide between the desires of sportsmen and the requirements of industry. Certain streams, usually small ones, are widely known as fishing grounds. When pollution enters, fishermen who were accustomed to use that stream as their recreation area, strenuously object to this pollution. Their organizations have been able, in some cases, to initiate laws forbidding any discharge of polluting wastes into those streams. This has imposed a heavy burden on the industries so located and has compelled them either to install expensive waste treatment facilities, to change their processes of manufacture, to reduce the volume and strength of the wastes, or even, in some cases, to abandon their plants and move to other, less restrictive locations. It has been necessary in several of these cases to adjudicate in law the rights of the stream users, to ascertain and determine which is the most important to the local economy—business or sport.

By pre-classification of all streams in a state, the prospective industrial plant owner may pre-survey the requirements and save himself the expense of locating on a stream where the requirements will cause him to spend inordinate amounts of money to meet those conditions. In anticipating the construction of any new plant which will produce a waste of any kind, liquid, solid or gaseous, it is wise for any industrial group to investigate the local rules and laws before making any decisions, or purchasing any property, or making any commitments.

Who Initiates Pollution Problems?

The industry producing the wastes actually is the initiator of the problem. But it does not develop into a problem until the stream becomes in such a condition that the health or comfort of the local residents is affected, or the state authorities specify that the wastes from that given plant are the cause of the trouble and issue an order for its discontinuance. In other cases, where streams have come under the protection of the municipal or state health authorities, or one of the numerous river control agencies, industry may be warned of the existing regulations and be required to show facilities to eliminate any pollution from their source before they are permitted to operate. Due to this, it is becoming common practice now to design the waste treatment facilities of a plant among the first items and to have these approved by the governing authority before construction of the plant is started. This is a wise procedure. It indicates to local and higher authorities that the industry is cognizant of its responsibilities and is taking steps to prevent any trouble.

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What Must an Industry do First?

When building a new plant in a locality where stream discharge of liquid wastes is permissible if certain conditions are met, the industry, or its engineers, should consult with local authorities and state or regional stream pollution authorities as to the extent of treatment they must provide. This entails a knowledge of the type, character, concentration and volume of the wastes to be discharged and an exposition of these to the authorities concerned. Many state, municipal and regional pollution authorities have adapted maximum requirements for industrial wastes to be discharged to streams. When the requirements are known to a qualified expert in the handling of industrial wastes, they will enable him to design a proper plant to produce effluents meeting those requirements. In many instances these standards call for maximum concentrations of suspended solids and/or total solids, biochemical oxygen demand (B.O.D.) color, chemical elements, etc. An experienced engineer can design a plant which will meet these requirements. In many cases these standards, particularly those which permit the discharge of wastes into a municipal sewerage system, will specify that any industrial waste so discharging must reduce its waste to approximately the strength and condition of the local sewage.

Most municipal sewage plants built today can handle wastes, to a certain degree, when they are reduced to the same general character as the sewage for which the plant was designed. Other municipal systems, not built with an idea of handling such wastes, may require that the industrial plant, if discharging into its system, must pay the extra cost of treatment engendered by the inclusion of these wastes, which because they may delay or upset the normal plant processes, will require the construction of additional or more complex units or methods of treatment. This may entail the construction of additional or larger units in the plant, pumping installations, or the use of chemical methods where before biological methods may have sufficed. In some cases, this has prompted the industry to build a pre-treatment plant immediately adjacent to the municipal plant.

Friendly and open minded discussion between the industrial plant management and the local or state authori-

ties can clear up these matters in short order and put the industry on a plane where it knows exactly what it has to do. Its engineers can go on from there. They should be participants in any of the joint conferences.

Problem of Design

After an industry has decided to locate in a given locality and its obligations as to wastes are understood and clearly defined, it should, if it has not already done so, engage an engineering firm competent in the handling of industrial waste problems. The function of this organization should be to study the particular wastes, the peculiar local problems, the laws and rules of local pollution bodies, and then to design for the client the most economical plant that will produce those results.

An industrial waste treatment plant must operate every day the plant producing the waste functions. Therefore, the plant, which uses recognized practical methods and means, which produces the desired results, and at the end of the year makes the least demands on the industry cash box, is the one that should be adopted.

Many methods and processes have been developed and have proven practical and sound for given wastes under given conditions. This never will indicate that any one given method, process or device will be suitable and practical for any type of industrial waste; that that same method may be the proper one to use on another waste which may seem similar to the one for which it was originally devised. Unfortunately, there has been too much of the adoption of units proven right for one specific case, as remedies for any waste treatment project.

A few years ago, in an effort to formulate a basis by which municipalities could make a charge against industries for handling their wastes in municipal sewerage system, the writer, as one of a committee set up in California, found that there were 72 different factors that might be necessary to consider in computing such a charge. Therefore, it was impossible to produce a formula which would satisfactorily answer all cases.

While an industry may, on first glance, produce the same goods in the same way, from the same materials, as one nearby, it is usually found that there are differences in the internal processes, the raw materials used and the extent of care in the manufacturing processes. All this may mean a different design of treatment plant.

Other elements which must be considered in evaluating an industrial waste problem seemingly have nothing to do with the technical end of the problem. But they have a very definite bearing on the final solution. Any industry which is located within the borders of a taxing authority (and where is there none) must pay taxes to that authority on its property, sometimes on its profits, and in many cases a sales tax. As a taxpayer, the industry is entitled to the same consideration as any other individual taxpayer. It has a right to the use of the utilities, facilities, public safety departments, sanitation and other activities of the community, as any other. It cannot, of course, abuse this right, but it must be recognized. And if, as a taxpayer, the particular industry is compelled to do inordinately expensive things to protect the town's systems, it has the right to appeal and request moderation of the demands. If the industry is located adjacent to a sewer line of sufficient size to handle its wastes, and the local municipality will accept this waste after treatment to reduce them to a standard suitable for treatment by their municipal plant or discharge into the stream, it should be permitted to use this method.

How to Treat the Wastes

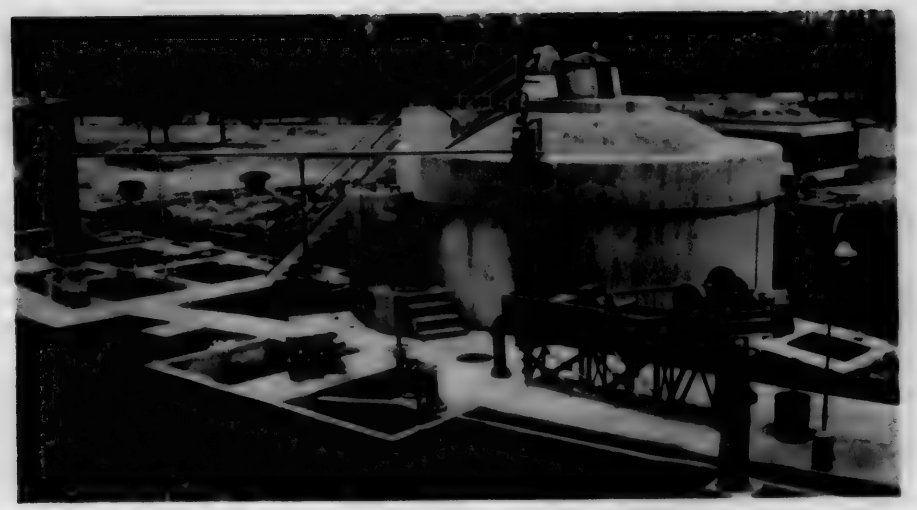
How to treat industrial waste is a matter which entails many considerations, such as:

1. Type of wastes, that is, from what type of plant.
2. Concentration or strength of the wastes—the type and proportion of polluting elements.
3. Volume of the wastes.
4. Toxic effect of wastes on the local stream.
5. Toxic or inhibitory effect of wastes on sewage treatment processes employed in the local plant, or in a future plant.
6. Requirements for the character of the final effluent.
7. Type and use of stream or body of water into which the final effluent would be discharged.
8. Classification of the stream, if any, by state health authorities establishing minimum requirements.
9. Possibility of discharging wastes into the local municipal sewerage system:
   a. Without pre-treatment of the waste.
   b. Without pre-treatment but with a charge for handling the wastes.
   c. Without pre-treatment but with industrial plant to pay cost of additional municipal sewage plant units required, or the annual cost of operation of same.
   d. With pre-treatment at works to reduce wastes to strength of municipal sewage.
10. Possibility of combining wastes with those of another adjacent industrial plant to obtain mutual reaction without additional chemical costs.
11. Local requirements as to character of wastes admitted to local sewerage system:
    a. Destructive to structures.
    b. Inhibitory or destructive of sewage treatment processes.
    c. Maximum suspended solids admissible.
    d. Maximum B.O.D. admissible.
    e. Acid or alkaline strength.
    f. Local restrictions against construction of treatment plants in plant locality.
12. The possibility and economy of recovering components of the waste for re-use in the plant or for sale.
13. The status of the industrial plant owner as regards percentage of employment of labor and importance economically to the municipality.
14. Remission of taxes paid by industrial plant toward payment of charges against plant for wastes.

These are the important and most usual factors that must be taken into consideration when studying an industrial waste problem, but as stated earlier, the writer discovered 72 different considerations which might enter into such a study.

Considerations for Type of Treatment

After consideration of these facts, as seem to apply in a given case and with the norms established, the designer



Plant in North Carolina which has as part of its treatment, the vacuum removal of light solids from industrial wastes. Photo, Dorr-Oliver, Inc.

can then consider the type of treatment to be used. This again involves a number of considerations, some of which follow:

1. Initial cost of plant.
2. Annual operating cost of plant and processes.
3. Area available for plant at works.
4. If treatment facilities must be inside a building.
5. If due to surrounding structures, plant must be housed or covered.
6. Availability of chemicals required.
7. Objection to aerial nuisance from bacteriological type of plant.
8. Esthetic considerations for the neighborhood.
9. Architectural necessities.

In many cases, individual industrial wastes may be effectively treated by either of several methods. It is the obligation of the designer to select and recommend the one which best meets the conditions and objectives named.

Charges for Operation

Industrial waste treatment is an item of expense which enters directly into the overhead of an industrial plant unless, and this is normally not the case, substantial revenues may be obtained from recovered by-products or reuse of components. The industrial plant owner is naturally interested in his annual bill for treatment which must be prorated against his production items and added to their cost. A substantial annual charge for waste treatment might add sufficiently to the overall costs of production of a unit to make a price increase necessary. In a competitive market, with prices kept low, this could be a serious matter. The first cost of a plant usually can be classed as a capital expenditure and written off by periodical amortization, but the annual cost of treatment goes on and on. Therefore, usually, first cost is not the most important item. The important item is the annual operating cost. This annual cost is made up of:

1. Interest on capital expenditure to build the plant.
2. Amortization or obsolescence rate set up.
3. Actual operating costs, which are:
   a. Labor actually used in operation or maintenance.
   b. Electric current or other fuel used in the operation.
   c. Supplies and repair parts necessary in the actual operation or upkeep.
   d. Chemicals, or coagulants, if it is a chemical type of plant.
   e. Supervision.
   f. Testing to see that satisfactory operation is maintained.

Credited against the operating bill would be the revenue from sale, or calculated use of any by-product or component. For instance, in a large plant having a waste with high organic solids content, a biological type of plant might be deemed most suitable. In this case there would be three natural by-products which would have a theoretical revenue or use value, depending upon the location of the plant, and the utility of the surrounding area.

In a biological type of plant there are these three end or by-products:

1. Digested sludge, usable as a soil conditioner or mild fertilizer.
2. Sludge digester gas, usable for power generation.
3. Treated effluent, usable for irrigation.

From a waste containing a high percentage of organic solids, the digested sludge provides a usable material, in a form readily handled, for soil conditioning, or as a base for a fertilizer. In a community surrounded by farms or truck gardens, this material may frequently be sold. This sale usually does not produce a profit on the entire operation, but the revenue received can be credited against the operating cost of the plant.

Gas Production

Likewise, when the organic solids are digested under the modern type of controlled digestion, the most valuable end-product is the volume of gas produced by the breakdown of the organic matter. This gas is normally high in methane (64-65%) and consequently has a high fuel value. It is common in municipal sewage treatment plants, especially those of large size, to use this gas in any one of a number of fully developed internal combustion engines to produce electric power. The development of these engines over the years has resulted in a type known as the "dual fuel-supercharged" type which is highly efficient

and produces a kilowatt of current for an input of around 6500 to 7000 Btu. This type of engine operates on a combination of a small amount (about 5% of the total fuel required) of diesel oil and the balance on digester gas. The engines are automatically controlled so that they reduce or increase the amount of fuel oil required to maintain the engine at full speed as the amount of gas increases or reduces. Normally, however, after a plant using anaerobic digestion of organic solids is in full operation, and the same flow of materials continues to come to the digester, the gas supply will be sufficient to operate the engine on an approximate 95 to 5% gas to oil ratio.

Economics of Gas Production

In the average municipal sewage plant, the gas produced in controlled digestion amounts to about one cubic foot per capita per day. With an engine producing one kilowatt of current for an input of say 7000 Btu, the gas produced from the wastes of about 12 persons will suffice. This is assuming the thermal content of the gas will be not less than 600 Btu per cu ft. It usually averages 650 Btu or more. As it is common practice to evaluate an organic waste on the equivalent population basis, it can be seen that a plant which had an equivalent population on suspended solids basis to 100,000 persons would have a gas production of around 100,000 cu ft per day. Assuming 600 Btu per cu ft, and 12 cu ft per kilowatt would show a potential of 8,333 kw per day.

In a plant using power purchased from an outside utility, it might pay the industry to install the engines necessary to utilize that potential power. While it might be a small item in the total power used by the industrial plant for its production purposes, it usually is more than ample to run the units of the waste treatment plant. Since this is a low cost power from a waste product, it would keep down operation cost of the plant. Thus assuming the industry pays 1 cent per kilowatt for current, the 8,333 kw from a population equivalent of 100,000 people would amount to $83.33 per day, or a total of over $30,000 per year. As the actual cost of production of this power from waste gas averages around one quarter cent per kilowatt, the actual saving, which could be credited against the operating cost of the plant, would theoretically be about $21,000 per annum.

Another advantage of this use of the gas is that in a sludge digestion type of plant the digesters, especially in the northern sections, are heated to a temperature of between 85 and 95 deg F. In producing power from the gas through an engine-generator set, the cooling water of the engine, passed through the engine exhaust heater, will provide ample heat units for the digester. Thus the power may be produced and the by-product heat used for the stimulation of the rate of digestion.

In cases where this production of power from gas is not considered practical, due to size or economic factors, the gas is useful in heating the digesters. In this case, the gas is burned under a boiler and the hot water circulated through the digester, through an external type of heat exchanger or by coils in the digester itself. Thus the cost of outside fuel to maintain the temperatural environment in the digester is eliminated.

In any case, the economics of the use of gas must be given careful study consistent with the local cost of power, its availability, standby charges of the local utility and the needs of the industry.

The digested sludge produced from anaerobic digestion has its use as a mild soil conditioner. It is low in nitrates, about 2 to 3%, has practically no phosphates, but for acid soils it is a useful correctant and for clay soils it opens up the pores, making it better for crops. As dried on open sludge drying beds, or through one of the several available heat drying systems which produce a powder or pelletized bagged product, it may be used on gardens of all sorts (except on vegetables eaten raw), on flower gardens, lawns, and parks. On any of these it will improve the condition of the product or the output. In numerous cases this dried, bagged sludge, is sold at prices from $5.50 to $10 per ton, and while again a profit cannot be looked for on the complete treatment operation, the amount received from the sale of sludge is an offset to the cost of plant operation. Such organic soil conditioners are commonly on sale at garden stores in all parts of the country.

Here again an economic study is necessary to evaluate all the factors as to whether drying for sale will pay.

In areas where water is scarce or costly to use for irrigation purposes and where a complete treatment of the waste is undergone, it frequently happens that the treated final effluent may have a use for irrigation of groves or other garden areas from which the product is not in contact with the actual liquid. In several cases, particularly in arid sections of the Southwest, plant effluents are used for irrigation, or for re-use in the actual plant. An outstanding example of this is the Kaiser Steel Plant at Fontana, Calif., where all liquid effluents from plant operations were so treated that the final effluents could be returned for re-use in the mill. This included the liquid from the flue dust recovery plants, the sewage treatment and the pickling liquors.

Types of Treatment

There are several basic methods or processes of treatment for industrial wastes:

1. Biological methods
2. Chemical methods
3. Combination of biological and chemical
4. Base exchange by synthetic resins
5. Evaporation
6. Compression distillation
7. Spray irrigation

Under these various heads come innumerable variations. Some wastes, particularly those with a high percentage of organic component, are susceptible of treatment by 1, 2, or 3, and for certain wastes, 7, especially cannery and dairy wastes, where suitable land is available. Which is the best for any given case is a matter of mature study. Biological methods usually require a higher initial construction cost but a lower daily operating cost. Chemical methods will normally provide a plant of smaller size and area requirement, but the chemical coagulants or precipitants required may run up a sizeable annual bill. Here there are a number of factors to be considered outside of the actual first and annual costs, such as:

1. Location of plant—whether area required for biological methods is available.
2. Surroundings of the plant—residential, business, etc.
3. Availability of the chemical elements required in the treatment.
4. Cost of the chemical elements.
5. Ease of handling the chemical elements—whether special metals or special clothing or precautions are required.
6. Disposal of resultant end or by-products.

Biological Methods

This refers to any of the developed methods whereby wastes may be adequately treated by the same methods and processes used in the handling and treatment of normal municipal processes. This includes the use of gravitational units for the removal of coarse solids and grit, and the use of normal biological units, such as contact beds, trickling filters, either of the low or high rate, with recirculation of effluent, or by the activated sludge type of unit, using diffused air or infusion of air by mechanical means, or a combination of these; plus the final anaerobic digestion of the organic sludge.

Such plants are usually the lowest in operating cost because once in operation, the operating charges include only the power required for operating the units (a small item) plus the small amount of labor required for attendance. As modern plants of this type are mainly automatically controlled, the average plant requires only the attention of one or two men. Their initial cost is apt to be relatively high and the ground area considerable, making it impractical to put a plant inside a plant building, except for very small units. Plants of this kind, particularly of the high rate trickling filter type, are very economical for many wastes as the process is not upset by flash shots of wastes or of changing volumes or characteristics. The annual labor problem is, therefore, reduced. Biological plants may be constructed so that gravity flows may be used to the utmost and pumping charges or multiplicity of pumping stations eliminated.

Factors Governing Chemical Treatment

If a waste is of such a character that the biological methods do not apply or the local conditions are such that sufficient area is not available for a biological plant, then consideration must be given to other methods. Chemical treatment usually requires less plant than biological types, but the daily use of an amount of chemical coagulant or precipitant is a substantial cost item. Thus, when it has been decided that chemical treatment is the proper one for a given case, the study must then consider the type of chemical to be used. In view of the necessity of always having in mind the annual cost of operation of a plant, the following points must be given mature consideration:

1. Type of chemical which will produce the result with the least amount added.
2. Type of chemical which will produce the desired result with least overall cost.
3. Availability of the chemical.

The first point involves the consideration, usually testing of a sample of the waste, with various chemical compounds which produce the desired result. In this consideration there must be a knowledge of the local availability of the chemical deemed best from a treatment standpoint. It frequently happens that a chemical which will produce a desired result is a proprietary item and must be obtained from a given source. Is this source at such a point with relation to the plant that a supply may be obtained at short notice? And at low transportation cost? If the source of supply does not meet those two conditions, then the cost of providing storage facilities and the capital outlay for a large supply of the chemical enters the picture. Also there is the question of deterioration of valency in a large storage of the chemical. Over what period may it be stored without loss or damage? Is it a hygroscopic chemical, needing dryness for storage, or to prevent spoilage?

Pressure flotation system used for handling packing house wastes from a San Francisco plant. Photo, Process Engineers, Inc.

While it frequently happens that such a special or proprietary chemical will produce a result with a minimum quantity per unit of waste volume, the above considerations may rule it out as against a chemical which is obtainable at sources close to the plant on short notice and which does not require storage of large quantities or high transportation costs. Let us assume a case.

Tests on a given waste show that a chemical costing 5 cents per pound produces the desired results in a short period, and that a dosage of 1 grain per gallon is required. On a flow of say 1,000,000 gal of waste per day, the total requirement then will be 143 lb per day (7000 grains = 1 lb), or a cost of $7.15 per day. On the other hand, it may be found that the use of 3 grains per gallon, or three times as much, of another, more common chemical, costing one-half cent per pound, may produce an equally good result. The cost of this is then $2.15 per day. Other than this, the more expensive chemical must come from a given source and sufficient supplies must be kept on hand to overcome the time of shipment required from the supplier to eliminate any possibility of the plant being shut down for lack of chemical. The other chemical may come from a local source and be in constant close supply, requiring no storage or chance of deterioration.

Handling the Chemicals

Another consideration in the use of the chemical processes is the handling of the chemical. Some chemicals may be handled as a dry powder and fed from a simple chemical feeder, which may in turn be controlled by automatic pH control, reducing or increasing the chemical as the waste characteristic demands. Storage hoppers may be provided that in many cases will hold sufficient supply for an entire day's operation, thus reducing the labor cost. In other cases, where chemical solutions are used, the control is more troublesome, as the small orifices required have a tendency to clog, or the chemical may be corrosive or poisonous and may require special care in its handling, or special clothing and protective equipment, or it may require the use of special metals in the equipment. These are important factors in the design of a chemical plant, as the element of danger to human beings in a plant requiring corrosive or dangerous chemicals may entail a special burden in insurance or compensation in case of injury. However, frequently, if an industry has very little ground available, or local conditions make it necessary to put the treatment in or on or under the plant buildings, then chemical treatment or one of the other non-biological methods may be the only answer.

Synthetic Resin Units

In certain wastes containing high percentages of minerals in solution, such as chromium, nickel, silver and copper, the recently developed synthetic resin units are applicable. Depending on the volume of the waste flow, these may be obtained from a number of sources in package units or for the larger volumes as open units, with the necessary interconnecting piping. The first cost and usage of space of these units, as they may be and usually are installed inside the plant, is relatively moderate. The operating cost, however, is high. The synthetic resins used have a definite capacity for removing the desired element, usually measured as grains per cubic foot of resin.

At the time the resins become exhausted (when the result is not correct), then the resin must be regenerated with an acid or an alkali to restore its usefulness. This entails having either duplicate units so there will be no interruption of service during the regeneration period, or of having storage facilities to overcome the shutdown period. The operation of regeneration can be made entirely automatic so that the labor element in this type of system is small. There is, of course, an additional problem produced, in the disposal of the waste wash waters from the cells. This, in itself might require an additional treatment plant. However, in cases of say chromium and nickel, the object is a recovery of the metal which has a value which can be charged off against the operation.

This type of treatment requires extensive test and experimentation before the plant design can be completed.

Recent developments in this phase of treatment units is in the form of synthetic membranes which are said to be able to remove the salt from sea-water to render it potable for humans. This is being studied in the semi-arid regions of the Southwest, where water supplies have been scarce.

Wastes from Wood Preparation and Alcohols

Certain wastes, such as those from pulp and paper mills using the sulfate and sulfite processes of wood preparation, have been a serious problem and much study has been given to its solution. Evaporation of the wastes is one solution but a costly one. Other solutions have been the use of the waste as binder for base material in road construction.

Evaporation has also been used in the handling of wastes from distilleries making whiskey or other alcoholic liquors, but recent developments in this field have shown that a combination of the normal methods of biological treatment may be used with satisfactory results at less operating expense. These wastes are normally high in B.O.D. and dissolved solids, but low in suspended solids. They can be treated on biological plants in the normal manner, but as they have very high B.O.D.'s, ranging from 15,000 to 30,000 ppm, this is not an economically practical procedure. Instead it has been found that by reversing the procedure, that is, putting all the wastes into the digester tanks first, reductions of from 70 to 80 per cent in B.O.D. may be made, thus reducing the total to such a point that the effluent may then be handled on biological filters, particularly the high rate type with recirculation, of relatively small area.

In this special field, it has been demonstrated that a very large volume of useful gas is produced in the digesters. One investigator, in experiments on such wastes found that for each cubic foot of volume in the digesters three cubic feet of gas per day could be expected. Assuming a waste of this type with a total daily volume of 100,000 gal, or 13,300 cu ft per day, the total digester volume would be approximately 79,800 cu ft. With an output of 3 cu ft gas per cubic foot volume per day, the total daily potential gas production would be 239,400 cu ft, which, in normal practice would be the same as would be produced in a sewage treatment plant treating the sewage of over 200,000 people.

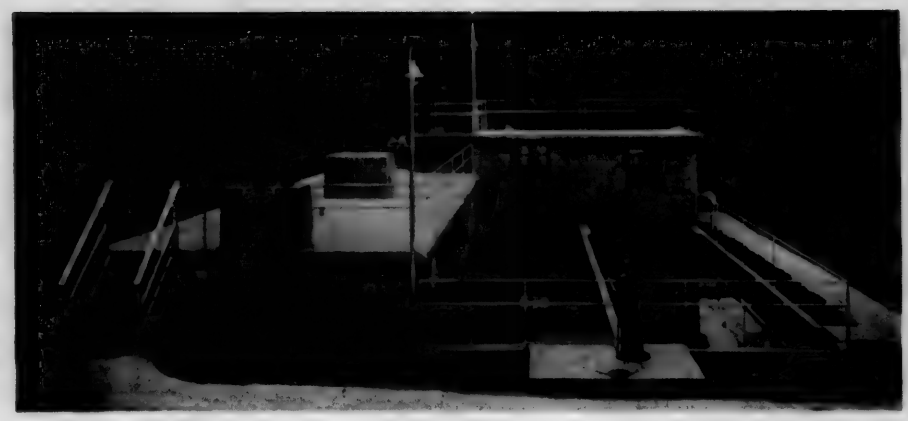
Activated Sludge Method

The activated sludge method, in its several forms, has applications in treating industrial wastes, particularly those containing organic components or those susceptible to oxidation by direct means. The principle of this method is that the oxygen required to stabilize the organic matter is applied directly to the waste by means of compressed air delivered through submerged porous tiles, tubes, or through jets, or is air inspired from the atmosphere by down draft tubes or other means. To assist in the oxidation, a portion of the bacterially active sludge formed in the operation is returned to the incoming raw waste.

In the most common form of this process, the great bulk of the air is used to keep the waste in agitation to prevent settling out of solid particles, and a very small proportion is used for the actual oxidation.

The principle advantage of the activated sludge method is that it occupies less ground area than the other biological types and, therefore, may cost slightly less to build. However, the cost of compressing the air required is considerable and makes the system expensive to operate.

Also, the system must be maintained in a delicate balance relation between the incoming waste and the return sludge, and if sudden slugs of excessive volume or strength of waste should be added to the system, it is quite easily upset and then requires skilled and close attention to return the plant to its normally satisfactory operating con-



Pump house, digester and settling tanks at Old Grand Dad Distillery, waste disposal plant, Frankfort, Ky. Photo, National Distillers Products Corp.

dition. A new development in this type of plant has come about with the advent of the new detergents, causing tremendous foam accumulations on the tanks. If the waste to be treated contains such detergents, it would be advisable to consider another method of treatment.

Combination of Wastes

When an industrial plant has a variety of wastes from different production operations on the same location, it is advisable for the expert to consider the components of each as a separate entity and then the possibility of combining two or more of them to obtain the natural reactions that may be obtained, say, from acid wastes with alkaline wastes. In this way, in many cases, the reactions are carried out without cost, whereas to provide the acid or alkali from outside sources would introduce an element of heavy expense. The same idea may be executed between separate industries in the same general area, by mixing their wastes and obtaining these mutual reactions, thus lessening the cost of treatment for each plant owner. This can be done by construction of a jointly owned and operated plant.

Equipment Available for Industrial Waste Treatment

Although industrial waste treatment plants may be designed without the use of mechanical elements, the experience and practice has shown that for any except very small plants, the introduction of mechanical devices introduces economies of a very important nature, both in the initial size and cost of the plant, in its operation, and in its control.

There are on the market today a very great number and variety of units of equipment and devices, developed and manufactured by responsible firms, which are applicable to inclusion in industrial waste treatment systems. In some cases, these manufacturers make a large variety of different types of equipment units, each of which is suited to certain applications and designed to achieve certain results.

In other cases, the manufacturer may have one type of unit only and may recommend this for any type of waste. This is not good practice nor will it always result in benefit to the industrial plant owner. No one system or method has yet been devised which is applicable to the treatment of every type of waste, and in my opinion, nor ever will be in the foreseeable future.

Each industrial waste situation must be considered independently by an engineer who is not bound by any biased idea for a certain type of equipment. He will, with the study of the particular problem, survey all of the available, proven methods or systems, and recommend or adopt the one best suited to solve the problem in the most practical and economical manner. In this he should be guided not only by his own knowledge of the performance record of the available equipment units, but also by the experience of those who have used them, and by unbiased information from the manufacturers. It is the duty of an engineer, called upon to unravel an industrial waste problem, to solve this problem and design that plant for the treatment, which will in his best judgment provide the adequate works for his client at the best overall financial conditions.

This may be a combination of the units, or devices of several manufacturers, although there are manufacturers now who provide a complete line of units for all phases or stages of a treatment works. If the units of that manufacturer are adaptable, economically and technically to a given case, it is wise to use the units of one firm to save the client from the nuisances of divided responsibility which can arise when the equipment units of several manufacturers are incorporated in the same plant and trouble arises in one of them. In some cases, the unit of one manufacturer might be slightly cheaper than that same type of unit of another manufacturer. It is considered good practice, however, to purchase the more expensive unit, where that manufacturer is supplying other equipment in order to have this undivided responsibility in the end.

Automatic Control

Another important factor in plant operation is instrumentation. In this automatic age, the general tendency is to provide automation for every type of operation. In general this is a sound idea, to have plant operations controlled by instruments, as it not only removes some of the inherent faults of human operation and control, but also provides indisputable printed records of what happened at a given point at any particular time. These records, in many instances, have value, but in many other cases they do not help in the operation of the plant. They are useful for making up tables for use in articles for technical publications, as a history of a given operation. The question of the extent of automation to be adopted in any case depends upon a number of factors, which may be enumerated as:

1. Size of the plant.

2. Relation of the cost of the plant to the cost of the automation.
3. Availability of manual help capable of controlling the operation.
4. Character of the operation to be controlled.

In a small plant, the operations of controls may be so infrequent that to provide automatic devices would not be warranted and the records that could be obtained, not required. In certain cases where health authorities of states or municipalities or pollution control entities have jurisdiction, they may require certain records to be kept to prove at definite intervals that the plant has been producing satisfactorily. This acts as a check on the detailed operation so that the agency, if results are deficient, can then check into the reason.

A periodical record is kept of tests to determine (1) suspended solids; (2) B.O.D.; (3) acidity; (4) toxic elements. These records, in some cases, must be made by laboratory analysis from samples of the waste, or in other cases, as of acidity or alkalinity, may be done automatically by pH recorders. Where laboratory analyses are necessary, samples must be taken at stated intervals and in proportion to the flow at that time, and these samples composited over a given period. These samples are frequently taken by an attendant who takes them from a given point at a stated time and measures his sample according to the flow at that time. But this requires someone detailed to do that work and adds an expense item to plant operation. There are available automatic samplers which will take the sample at the proper time, in proportion to the flow, and deposit it in the necessary receptacle.

The measurement of flow is best done by automatic means, by one of the many means available: Weirs, Parshall flumes, nozzles and orifices of various type which are connected to indicating-registering and recording devices and provide a printed, indisputable record of the flow at any given moment. These are, except in very small plants, considered essentials.

Where acid wastes are being treated and the pH of the final effluent may be closely controlled, this operation is a tedious one for a manual operator, and involves a loss of time in compensating the neutralizing agent with the flow. A considerable lag is introduced between the time the man takes the sample, makes the titrations, and then adjusts the feeder of the neutralizing agent to the proper point. By that time the reaction may have changed and the result may be a waste of neutralizer or too little of it. The modern automatic pH control, which is immersed in the flow at all times, keeps a constant record of the pH at any given point or points, controls the neutralizer feeder instantly to add or decrease that agent at that moment, thus smoothing out the operation and keeping cost down. This is an essential in a well-designed plant.

In general the extent of instrumentation must be given considerable thought and a logical conclusion established. If the plant is small, instrumentation is expensive and it may be out of economic reason to apply too much of it, where the needed control might be accomplished by one man at less cost than the interest and amortization on the instrumentation.

Manufacturers of control equipment will, in most cases, be willing to advise on this point—how to maintain the proper balance between desire and necessity in the number and complexity of instrumentation. This should be a function for the decision of the engineer commissioned to design the plant.

Equipment for industrial waste plants runs the relatively same gamut as that available to the sanitary engineering profession for the design and operation of water and sewage treatment plants. It includes devices for obstructional removal of coarse solids, such as bar and fine screens which remove solids only because of their inability to pass through the apertures in the screen. Also it includes devices, known as grit chambers, which remove inorganic solids by gravitational means. These units take a variety of form. Some are square and collect the solids and wash them free of organic matter, providing a grit that may be used as fill in low ground. Others separate the grit and organic solids by air jets; others are not mechanically equipped but depend upon centrifugal force to separate the solids; others provide a combination of separation of grit and organic matter by vacuum in which the grit settles to the bottom of the unit and the lighter, air bouyed solids are induced to rise by the vacuum.

Agitation and Flocculation

It is quite common in waste treatment plants, especially where neutralizing agents or other chemicals are added, to provide mechanical agitators to assure complete diffusion of the chemical throughout the liquid mass. These are of various forms, from simple paddles on the end of a shaft, to devices scientifically designed with impellers developed to cause a definite circulation of the liquid.

In other cases, a phenomenon known as "flocculation" is employed. Chemicals are added to change the iso-electric character of the solids to cause the solids to coalesce and form particles, called flocs, which will settle quickly. In its basic form, this contemplates causing the tiny or pin-point particles formed in the preceding mixer to be circulated through an infinite number of vertical, horizontal or oblique paths through the liquid. In this intricate passage of the particles, they impinge upon one another, adhesion takes place and the particles grow and become dense and heavy. At the same time, as they pass through the liquid they tend to attract other particles to themselves thus acting similarly to sponges. These stimulated flocs are in the general form of pellets, with a small surface area exposed to upward currents and when the force of the agitation of the flocculation mechanism is released, they settle rapidly to the bottom of the following sedimentation basin. When flocculation is indicated in a treatment, the type of flucculation unit which imparts this "barrel-rolling" effect to the contents of the tank is the most effective in reducing the amount of reagents required, thus introducing an important element of saving.

Sedimentation

Sedimentation, another example of the gravitational separation of solids from liquids, is employed quite generally in various types of waste treatment plants. It has various forms, some consisting of plain concrete tanks, in which the solids settle but which must be drained to clear them of the accumulations. This entails the use of two or more tanks so that there may always be tanks available for service when the others are being cleaned.

For many years this type of tank, except in very small plants, has been outmoded by the mechanically cleaned tank.

The mechanically cleaned sedimentation tank was developed in the United States about 1916, as a modification of a unit originated for use in metallurgical work. In its first form it consisted of a series of arms thrust out from a central shaft. These arms were equipped with scraper blades and as the arms were moved around the tank by the motor driven shaft, they caused the semi-fluid sludge to move to the center of the tank where an outlet was provided. The effect of this was to provide continuous removal of the settling solids so that no accumulations occurred. Thus the volumetric efficiency of the tank was maintained at its maximum at all times. The immediate effect of this tank was to destroy the need for duplicate units.

Since this initial design, many variations of the mechanically cleaned unit have been developed by various manufacturers but the basic principle still remains the same—to remove the settled solids, technically known as sludge, from the tank in a daily amount equal in volume to the amount that would be deposited in one day. This is accomplished in some designs by keeping the sludge collecting rakes in operation continuously, in others it is done by operating the rakes periodically. In their present form the mechanically cleaned sedimentation tanks take two shapes, circular and rectangular or square. There are proponents of each type and each side can produce good arguments why their type is best. There are natural considerations which govern the selection of either of these types, such as ground conditions at the site, area available, number of tanks to be considered, conjunction with other plant structures, and esthetic arrangements. Examples of each type are numerous and records exist of satisfactory operation in waste treatment plants. The adaptation of any particular type, shape or style of mechanically cleaned sedimentation unit is a matter for the designing engineer.

Filters

In a biological type plant, the effluent from the sedimentation units is treated on various filters. These may be sand beds, known as slow sand filters, contact beds (concrete or brick structures filled with stone), or trickling filters. The slow sand filter has practically passed out of use, except in very small installations due to the large area of bed required. The contact bed, likewise, has become obsolete. The trickling filter, which is a bed of broken stone from 3 to 8 ft deep, upon which the clarified waste is sprayed or discharged, is the most commonly used of the various biological units available. This unit has two general types, one known as "slow rate" or "conventional" and the other as "high rate" with recirculation of effluent. The slow rate type was based on the discharge of the waste to be treated to the surface of the stone. The liquid thus applied, then trickled downward through the interstices of the stones. These stones gradually became coated with a slimy zoogleal jelly which sustained the aerobic bacteria that devoured the organic matter and stabilized the liquid. In this type, the liquid passed through the filter but once.

In the high rate type it was found that if the liquid to be treated were to be passed through the filter several times instead of once, the ability of the filter to stabilize organic matter and reduce B.O.D. was materially increased. In the slow rate type the amount of B.O.D. per cubic yard of filter stone was relatively low, but in the high rate filter it was found that by recirculation of filter and sedimentation tank effluent through the same filter several times, the capacity of each cubic yard of filter to remove B.O.D. was materially increased. Thus a filter of this type could be less in diameter and depth than the older type and consequently less in cost. The capacity of the slow rate filter was in the order of 2.0 million gallons of liquid to be treated per acre per day. On the high rate filter with recirculation, the rate of application may run as high as 30 million gallons per acre per day. There are two forms of this high rate type, one which prescribes constant recirculation of a given amount of filter and final settling tank effluent per minute, and the other which operates on the principle of maintaining a constant volume of flow through the filter and varying the recirculation rate in accordance with changes in inflow to the plant.

The high rate filter, due to its lessened size and depth has many applications in industrial waste treatment work, especially in those cases where the wastes contain large percentages of organic compounds that may be stabilized by oxidation.

A variation of the biological plant using trickling filters is to add a final step of aeration to polish the effluent. Which of these variations is most practical and economical for a given problem is the province of the engineer.

Digestion Tanks

Where sedimentation is employed, sludge results. As this is the most troublesome element in sewage and contains the solids which are the most potent causes of complaint, special means must be employed to handle and stabilize these organic matters. This has resulted in the development of the anaerobic digestion step, in which the semi-liquid sludge from the sedimentation tanks is put into a closed tank where the anaerobes (the bacteria which function in the absence of air) devour the organic matter. This operation must be closely controlled to produce the desired result—a volume of odorless residue, averaging about 50% of the original mass.

In any digestion tank, if the mass of daily incoming solids is left to itself it will, in time, produce a digested sludge, but this takes so much time and requires tanks of such large volume that it is not considered good practice to permit the solids to take their own course. Therefore, it is common practice to control the reactions and the environmental conditions in these tanks so as to hasten the digestion phase, thus permitting the use of lesser volumes of tank capacity.

As all organic solids pass through a range of reactions, the first of which is to form an acid, the best practice today calls for the digestion tank to be put completely on the alkaline side by the addition of an alkali to it for a short period. With the mass in the tank representing from 15 to 30 days accumulation of the digested sludge entirely on the alkaline side, the addition of the daily volume of digested sludge will not upset this alkaline balance. The result of this is digestion without the pro-

duction of odors but with the production of a very appreciable volume of useful gas of a methane content which makes it a valuable fuel which may be used as explained before. However, this is a secondary consideration, the main one being that the operation is free from odors or nuisance. The digested sludge, discharged periodically from the tank, can be dried without nuisance on open sludge beds, or in any one of the various types of heat drying systems.

The digesters are of various forms. Some are based on the principle of one tank alone, other systems use two tanks. The first of the two tanks is the primary tank receiving the sludge from the sedimentation unit. In this tank the reaction is controlled and the temperature is maintained between 85 to 95 deg. The second tank, which is not heated or controlled, often is equipped with a rising steel cover to act as a reservoir for the gas produced. In several forms the primary tanks are equipped with mixer units for causing a circulation of the tank contents, to mix the digesting material with the incoming raw sludge and thus initiate more rapid digestion. It also prevents the formation of surface scum mats which would prevent the emission of the gas.

Tank Operation

Where the plant has primary and secondary (final) sedimentation tanks and sludge is produced in both of them, it is common practice to pump the sludge from the secondary tank back to the inlet to the primary tank so that this final sludge, which is usually lower in solids content than the primary sludge, is consolidated with the primary sludge and a sludge of lower moisture content is pumped to the digestion system.

Recently, developments have shown that by decreasing the moisture in the sludge going to the digestion tanks, the volume of digestion space may be materially lessened and thus considerable plant savings made in construction and operating costs. In one form, this consists of putting the raw sludge from the sedimentation units into a thickener unit which tends to squeeze the occluded water from the sludge and a final sludge produced with a solids content of from 12 to 15%. In several instances where this system is used, it is said that digestion volume may be reduced as much as 50%. Other variations of this same idea consist in the practical cooking of the sludge, another with freezing of the sludge, but the basic idea is the same, to reduce the actual moisture content and produce a denser mass for the digester.

Pumps for sludge are usually of the piston or plunger type, with provision for regulating the length of the stroke so that the capacity of the pump may be changed at will to conform to the amount of sludge to be pumped. These are the most effective pumps for sludges as they may be so regulated as to pull low moisture sludge without danger of a break-through of liquid. Centrifugal pumps, which must run at a relatively high speed, cannot be so regulated.

Dewatering Digested Sludge

In the dewatering of the digested sludge for final disposal or use, there are usually two steps employed. First the digested sludge, which may have a solids content of from 90 to 95%, is put onto a vacuum type of filter. With previous addition of a conditioning agent which may be ferric chloride, ferrous sulfate, aluminum sulfate or lime, or a combination of them, the sludge is picked up on the surface of the revolving drum of the filter and by means of vacuum exerted from inside the drum, the occluded water is removed from the sludge. As the drum revolves, the dried cake adhering to the filter medium is released and falls off in the form of a sheet, with the appearance of asphalt roofing paper and is carried to the further drying unit by belt conveyor. The final solids content of this cake may be of the order of 70 to 72%.

These filters operate in various ways. Some of them cover the drums with cloths of wool, cotton, or synthetic fibers and depend upon scraper blades to assist in the removal of the filter cake. Others, have a series of strings laid on the drum which lift the cake from the cloth on the discharge side and assist in its removal. Still another form, more recently developed, is unique in that the filter medium consists of a closely set series of wire springs wound around the drum. One layer of these spring wires follows grooves in the filter drum and an upper layer which lies in the hollow between each pair of lower wires, form the filter surface. As the drum revolves and the wires approach the discharge point and pass over rollers, the wires flex permitting a release of the grip on the springs, and the upper wires rise above the lower ones, thus carrying the cake to the discharge point.

Other forms of vacuum filter require the addition of a precoat layer of material to the filter medium. As the drum reaches the discharge point, the sludge cake and a small portion of the precoat is scraped off so that a reservoir of precoat material must be maintained to continuously recoat the filter.

Which of these variant forms of vacuum filter is the proper one for a given case involves mature consideration of a number of factors and should be a matter of consultation between the plant designer and the equipment manufacturer.

In selecting equipment for a given plant, it should be realized by any engineer that each manufacturer knows the abilities and possibilities of each unit of his equipment. It is believed best practice, when considering the use of any equipment, to consult the manufacturer and give him a clear understanding of the objectives. Each manufacturer of equipment has several forms of units, each of which is definitely best suited for certain conditions. He knows, better than anyone else, the limitations of these units for a given case and when consulted will recommend the use of the proper unit. This acts as insurance that the proper unit is being selected in much more satisfactory and trouble-free service for the client.

The cardinal point to keep in mind in handling industrial waste problems is that there is no cut-and-dried rule for solving them. The art of industrial waste treatment is unstatic and empirical rules cannot be established. Each case must be considered as an individual problem and be submitted to the scrutiny and study of experienced engineers who will endeavor to work out the most practical and economical solution for the client. If this rule is followed, the pollution control authorities will have less reason for imposing penalties on polluters as the cost of waste treatment plants will be reduced and industrial plant owners will be more willing to undertake their construction, without procrastination and delay.

INDIRECT WATER HEATERS

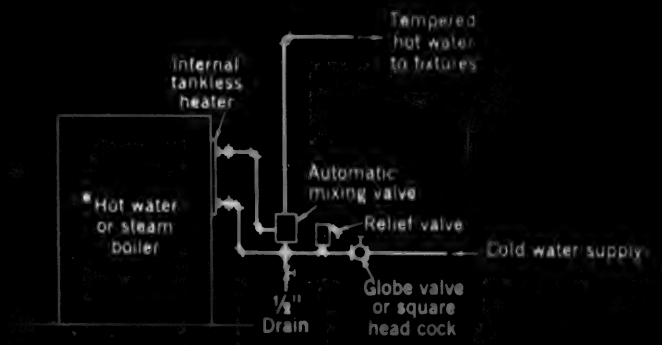


FIG. 1 INTERNAL TANKLESS HEATER WITH STEAM OR HOT WATER BOILER

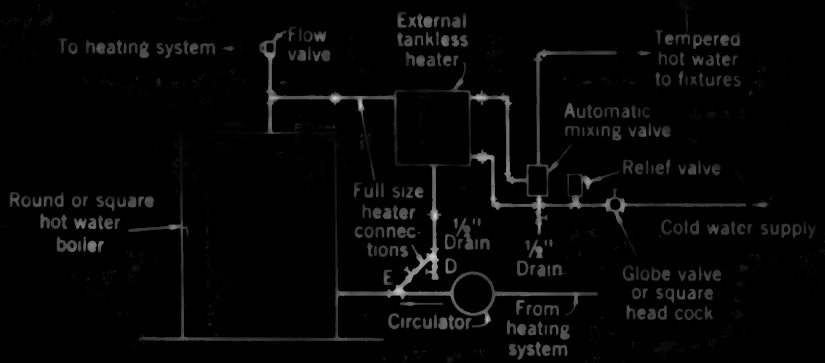


FIG. 2 EXTERNAL TANKLESS HEATER WITH ROUND OR SQUARE SECTIONAL HOT WATER BOILER

* With a hot water boiler, some means to prevent the circulation of hot water to the radiators when heat is not required must be provided. This may be done by a thermal or electronized valve or by a flow valve operated by a circulating pump.

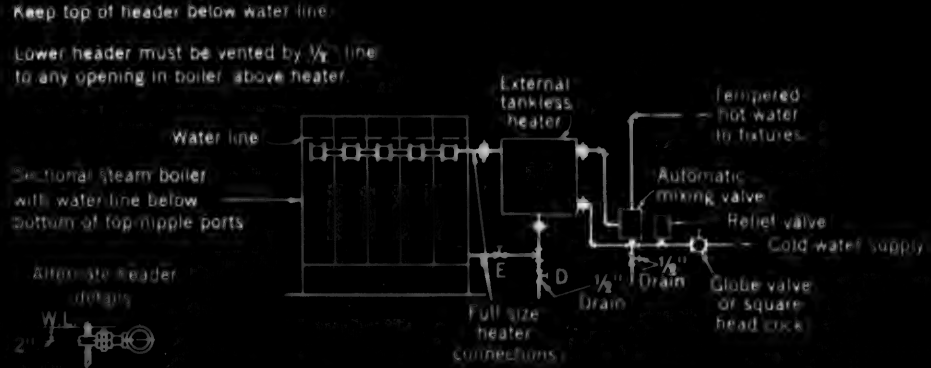


FIG. 3 EXTERNAL TANKLESS HEATER WITH SECTIONAL STEAM BOILER. WATER LINE BELOW BOTTOM OF TOP NIPPLE PORTS.

Size of Tapping in each section			
Header size, inches	Sections in boiler		
	3	4	5
	Tapping size, inches		
2	1¼	1	1
2½	1½	1¼	1¼

CUT ALONG THIS LINE

INDIRECT WATER HEATERS

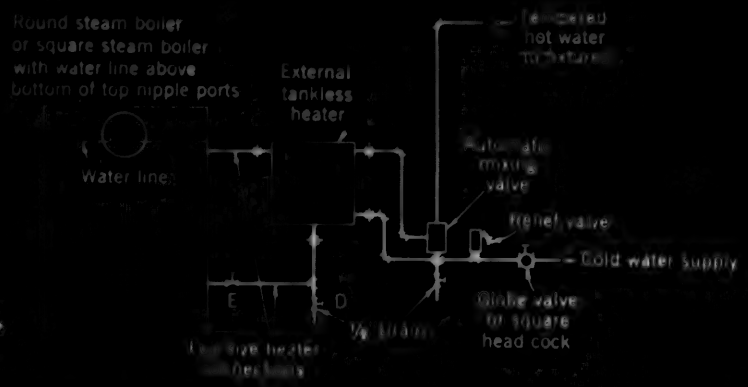

Round steam boiler or square steam boiler with water line above bottom of top nipple ports
Water line
External tankless heater
Heated hot water to fixtures
Automatic mixing valve
Relief valve
Cold water supply
Globe valve or square head cock
E
D
⅛" Drain

FIG. 4 EXTERNAL TANKLESS HEATER WITH ROUND OR SQUARE SECTIONAL STEAM BOILER—WATER LINE ABOVE BOTTOM OF TOP NIPPLE PORTS

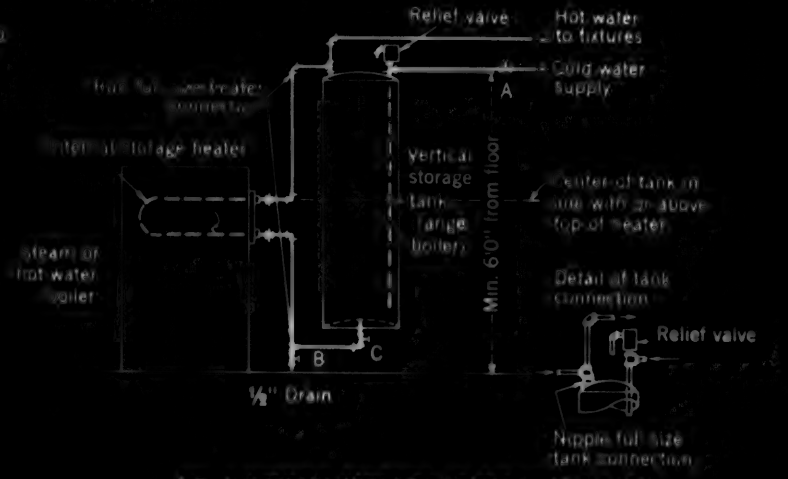


FIG. 5 INTERNAL STORAGE HEATER IN STEAM OR HOT WATER BOILER WITH VERTICAL STORAGE TANK

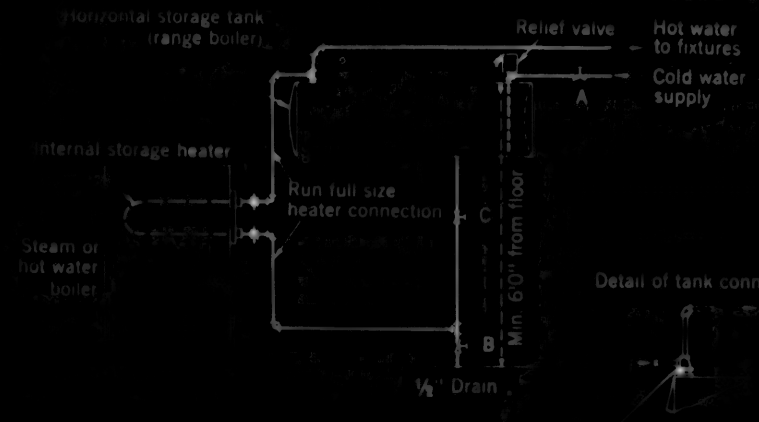


FIG. 6 INTERNAL STORAGE HEATER IN STEAM OR HOT WATER BOILER WITH HORIZONTAL TANK

TO FLUSH TANK AND HEATER

To flush tank, open valves A, B and C.

To flush out coil of heater, close valve C, open valves A and B.

To flush out shell of external heater, close valve B, open valve C.

DRAWINGS THROUGH THE COOPERATION OF THE INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS

What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

THE present problem for discussion concerns a flooded evaporator for use in chilling water. It has a number of questions that should be of interest to engineers who have to operate similar type systems.

Should you have a problem that you would like to have treated in this department, or if you have some comments that you would like to add to the coming discussion, you are invited to write to the Editor.

This Month's Problem

We have a system for chilling water which uses a flooded evaporator. With this type evaporator, what should be the superheat setting of the expansion valve? In figuring the size suction connection to the refrigerant shell around the water tubes, what should be the pickup velocity at low load conditions? Under what conditions, if any, will there be trouble with oil return?

Discussions by Readers

There are several designs of flooded evaporators on the market, the majority used for cooling water. Their construction usually involves a refrigerant shell containing bundles of water tubes. The primary problem in piping a flooded evaporator is that of oil return since the large shell area results in very low gas velocities at the liquid surface. This tends to trap and hold lubricating oil, often necessitating the use of a liquid Freon or hot gas heated still to separate and return oil.

A schematic representation of a flooded evaporation is shown in Fig. 1. Used in the hookup is a thermostatic expansion valve control as that is normally preferred. The suction connection to the refrigerant shell should be sized so that pickup velocity at minimum load conditions will exceed 1,200 fpm and this same velocity should be maintained in the horizontal pickup header and vertical header stub. The heat exchanger should be located in the horizontal line as close to the evaporator as possible, and the expansion valve bulb located on the suction line between the heat exchanger and the compressor so as to give the chiller the benefit of superheating effect of the heat exchanger. Actually, this is the only bulb location which will give proper system operation, both from the standpoint of system capacity and also as regards compressor safety.

The system should be run with superheat setting on the expansion valve of 8 to 12 degrees higher and the system should be charged at full load so that liquid Freon is leaving the condenser 10 deg sub-cooled. Head pressure should be controlled so as to maintain whatever liquid temperature for which the heat exchanger was designed. A solenoid valve should be installed in the liquid line at the evaporator to close when the compressor stops.

At full load, there will be some turbulence in the evaporator, more or less depending on the ratio of cross section area to depth, which will throw oil and liquid Freon into the leaving gas stream. The oil will be carried back

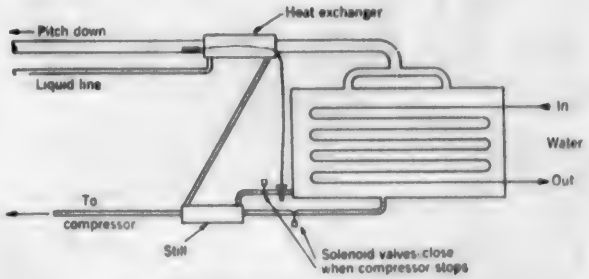


Fig. 1. Flooded evaporator connections.

to the compressor and the liquid Freon will be evaporated in the heat exchanger. As this load decreases, the turbulence will decrease, but the expansion valve will feed more refrigerant in an attempt to maintain its superheat setting, thereby raising the evaporator liquid level and maintaining the oil-Freon pickup by the suction gas flow. The maximum height of Freon in the evaporator is controlled by the amount of charge in the system and should be reached at approximately the compressor shut-off point.

If the evaporator has a high ratio of cross section area to depth, there may not be enough turbulence to obtain oil return under any conditions. If this is the case, a still must be used and piped as illustrated. A small condenser, or a heat exchanger, with capacity equal to that recommended by the evaporator manufacturer, will serve as a

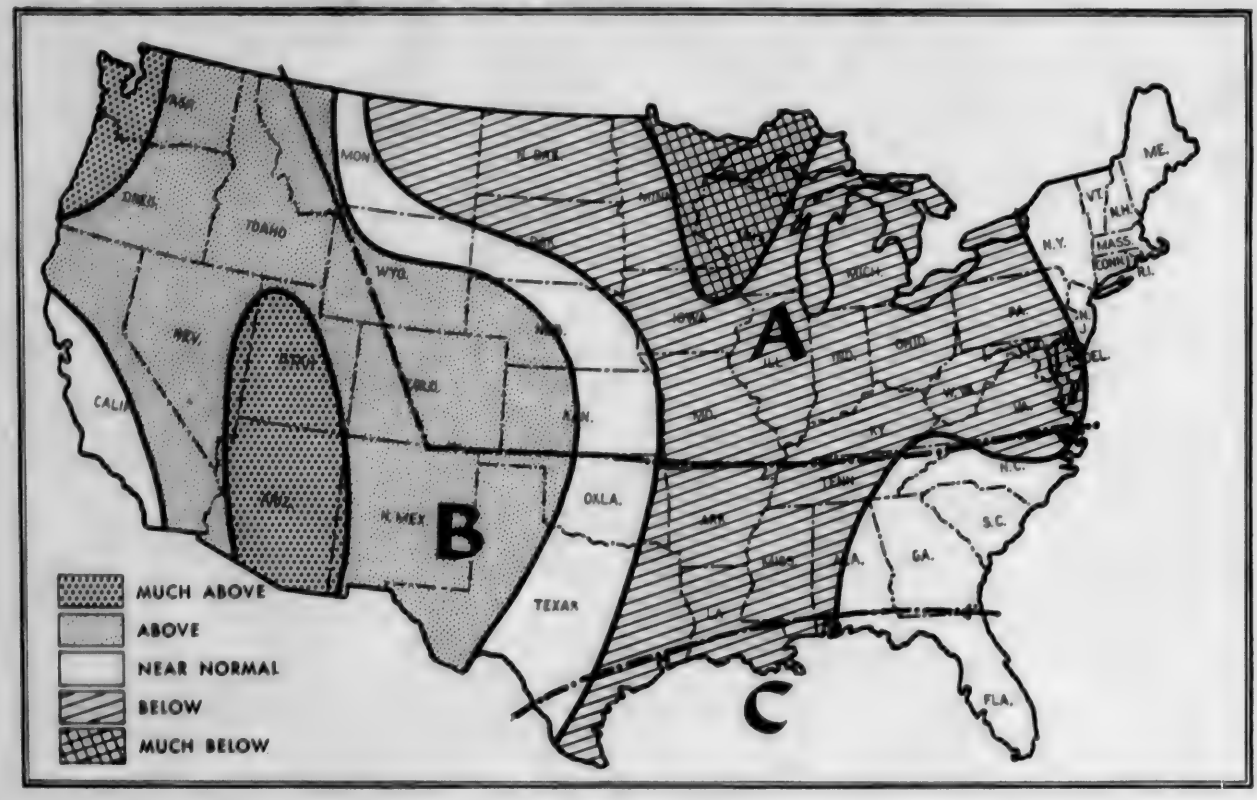
(*Concluded on page* 174)

Problem for the Next Issue

I am planning a survey to see that the many pumps we have in our chemical plant are being properly used. I am interested in selection data which shows the proper type pump and impeller for various liquids and also what material is best for pumps in relation to the liquid handled.

Temperature Forecast for April

Prepared for Air Conditioning, Heating and Ventilating by Long Range Weather Consultants.



KEY BY REGIONS

	A	B	C
MUCH ABOVE NORMAL	+5° or more	+4° or more	+3° or more
ABOVE NORMAL	+2° to 4°	+1° to +3°	+1° to +2°
NEAR NORMAL	+1° to −1°	+1° to −1°	0°
BELOW NORMAL	−2° to −4°	−2° to −3°	−1° to −2°
MUCH BELOW NORMAL	−5° or more	−4° or more	−3° or more

IN this forecast, the terms *warm* and *cold*, or *warmer* and *colder* are always relative to the normal. Thus if the first part of April is forecast to be *warm* and the latter part *cold* it does not necessarily mean that the latter part of the month actually will have lower temperatures than the first part, but only that in comparison with what is normal or usual at the time it will be colder.

Do not confuse the regions with the forecast areas. Region A consists of all the northeast portion of the U. S., region B of the west and all of the south except the Gulf Coast which comprises region C.

April will be a moderately cold month quite generally in the eastern half of the country, and in the northern tier of states westward to central Montana. Coldest conditions are expected in the area just west of the Great Lakes, with much lower than normal mean temperatures for the month indicated for parts of Wisconsin, Iowa and Minnesota. On the other hand, mean temperatures only near or slightly below the normal are expected along most of the Atlantic seaboard, and in western portions of the tier of states just west of the Mississippi River.

In most of the eastern and north-central portions of the country for which near-normal temperatures have been forecast for April, the colder weather is expected during the first half of the month, with a rising trend indicated during the latter part of the month to above normal temperatures by the end of the month.

West of the Continental Divide, and in central and southern sections of the western Great Plains area, April will be a moderately warm month. Temperatures as much as 4 or 5 deg above the normal mean for the month are expected in Utah and Arizona, and in western portions of Washington and Oregon. However, in coastal sections of central and southern California temperatures only near or slightly above the monthly normal are indicated.

In this western portion of the country warm weather conditions of April are expected to be established early in the month, with the possibility that it will be somewhat cooler during the latter part of the month, but no extended period of sub-normal temperature is expected.

APRIL TEMPERATURE FORECAST

The temperature forecast covering the month of April for the United States which appears on the opposite page is a new feature of AIR CONDITIONING, HEATING AND VENTILATING; a similar forecast will appear each month.

In addition to the monthly forecast, every third quarter a 90-day forecast will appear. The first of these will be published in the June issue.

This forecast is prepared by Long Range Weather Consultants of Boston. The firm consists of Professor H. C. Willett, Professor of Meteorology, Massachusetts Institute of Technology; I. I. Schell, Research Associate, Tufts College, and William C. Morton III, Department of Meteorology, Massachusetts Institute of Technology.

Both Professor Willett and Mr. Schell have been making long range weather forecasts with measurable success since 1940 and have provided forecasts to the hydroelectric, canning, textile, movies, and other interests. Mr. Morton joined the group in 1952.

The method of forecast developed by the firm is based on weather data from the entire northern hemisphere and a large portion of the southern hemisphere.

It is hoped that this forecast will prove not only of interest to the readers of AIR CONDITIONING, HEATING AND VENTILATING, but useful as well. The editors will welcome comments from readers.

BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

MECHANICAL EQUIPMENT FOR BUILDINGS

Recently published, is the third edition of Mechanical and Electrical Equipment for Buildings. The authors are the late Charles Merritt Gay, professor of architectural construction, University of Pennsylvania; Charles De Van Fawcett, professor of electrical engineering, University of Pennsylvania; and William J. McGuinness, professor of architecture, Pratt Institute.

Virtually every page of the earlier edition has been rewritten and the section on elevators and escalators has been enlarged. New data are presented on recently developed pumps, baseboard heating, forced warm air heating, radiant heating, zoning systems and controls for hot water heating, and the Metro system of steam heating.

In general the subject matter of the book is grouped in six main sections as follows: Water supply, sanitation, heating, air conditioning, electrical equipment, and accoustics. In additon to basic information, there are chapters on design methods and computations. Included are a number of typical problems and their solutions.

The earlier editions of this book were written by Gay and Fawcett. Mr. McGuinness appears as a co-author for the first time, in the third edition.

Mechanical and Electrical Equipment for Buildings, by C. M. Gay, C. De V. Fawcett, and W. J. McGuinness. Cloth bound, 5⅜ x 8⅜, 564 pages. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price, $8.50.

NATIONAL PLUMBING CODE

For some time there has been recognition of the importance of a national plumbing code which would simplify design and installation practice, and eliminate some of the confusion that is the result of too many codes now in use. A committee to study minimum requirements for plumbing and the standardization of plumbing equipment was formed as early as 1928 by the American Standards Association. Since then there has been work towards the objective of a national plumbing code by other groups.

The present code is sponsored by The American Public Health Association and The American Society of Mechanical Engineers. Recommendations in the code are based on research in the field of plumbing partly financed by HHFA and the U. S. Department of Commerce conducted at the National Bureau of Standards, University of Iowa, University of Illinois, U. S. Public Health Service Environmental Center and other laboratories.

It is believed that this code will serve in providing the basis for an American Standard. It should be of immense value to cities that wish to revise an antiquated code or to municipalities that now operate without a code.

Beside covering basic principles and definitions, the code covers materials, joints and connections, traps and cleanouts, interceptors, plumbing fixtures, hangers and supports, waste piping, water supply, drainage systems, vents, storm drains and inspections and tests. In addition, the book has a section of 52 pages for a number of appendices.

National Plumbing Code. Paper bound, 5¼ x 7¾ inches, 174 pages. Published by The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $3.50.

PLUMBING ESTIMATING

As a means of helping the contractor arrive at a more accurate estimate and in less time, George L. Sherlock has written the Blue Book of Plumbing Estimating. Averages used in the book were compiled from hundreds of jobs, and estimating charts are included to give figures for the average job.

A large part of this book is devoted to job layouts, installations and service data with pipe layouts for some of the basic installations. The section on estimating has a large number of blank pages for entering personal information.

Blue Book of Plumbing Estimating by G. L. Sherlock. Cloth bound, 5 x 8¼ inches, 241 pages. Published by Estimating Handbooks Associates, De Kalb, Ill. Price, $7.75.

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RATING CODE FOR STEEL BOILERS—The Steel Boiler Institute, Inc., has issued the sixth edition of the Rating Code for Steel Boilers. The previous edition was dated January, 1948, and many changes have been made as compared to the earlier edition. The former "Commercial" series is now designated as "Table 1 Boilers" and three larger sizes have been added. Boilers formerly termed "Residential" are now designated as "Table 2 Boilers." Steel Boiler Institute, Inc., 1308 Land Title Bldg., Philadelphia 10, Pa. Price, $1.

Vertical Wet-Pit Centrifugal Pumps

IGOR J. KARASSIK and ROY CARTER

Centrifugal Pump Division, Worthington Corporation, Harrison, N. J.

Eleventh in a series of articles on centrifugal pump types and applications, the discussion this month covers mechanical and hydraulic characteristics of vertical-shaft pumps with impellers submerged.

VERTICAL pumps intended for submerged operation are manufactured in a great number of different designs, depending mainly upon the service to which they are intended. Thus wet-pit centrifugal pumps can be classified as:

(a) Vertical turbine pumps
(b) Vertical wet-pit propeller or modified propeller pumps
(c) Wet-pit sewage pumps
(d) Wet-pit volute pumps
(e) Sump pumps

Vertical Turbine Pumps

Vertical turbine pumps were originally developed for pumping water from wells and have been called deep well pumps, turbine well pumps, or borehole pumps. As their application to other fields has increased, the name vertical turbine pumps has been generally adopted by the manufacturers. (This is not too specific a designation because the term "turbine pump" has been applied in the past to any pump employing a diffuser. There is a tendency to designate pumps using diffusion vanes as diffuser pumps as against volute pumps. As that designation becomes more universal, applying the terminology of vertical turbine pumps to the construction formerly called turbine well pumps will become more specific).

The largest field of application for this type of pump is pumping from wells for irrigation and other agricultural purposes, for municipal water supply and for industrial use for processing, circulating, refrigerating and air conditioning water supplies. In addition this type of pump has been used for brine pumping, mine dewatering, oil field repressuring, and other applications.

These pumps have been made for capacities between 15 and over 25,000 gpm, and for heads up to 1000 ft. Most applications of these pumps are naturally for the smaller capacity field. When they are used for pumping from bored wells, the capacity is naturally limited by the physical size of the well in which the pump will be installed as well as the rate at which water can be drawn from the well without lowering the water level in the well to the point where there is insufficient submergence.

In a vertical turbine pump it is desirable to have provision so that the shaft can be readily raised or lowered from the top in order that the position of the impeller in the bowl can be adjusted properly. In addition it is necessary to have an adequate thrust bearing to support the vertical shafting, the impeller and the hydraulic thrust developed when the pump is in service. As the driving mechanism must also have a thrust bearing to support its vertical shaft, it is usual to provide a thrust bearing of adequate size in the driving mechanism to carry the pump

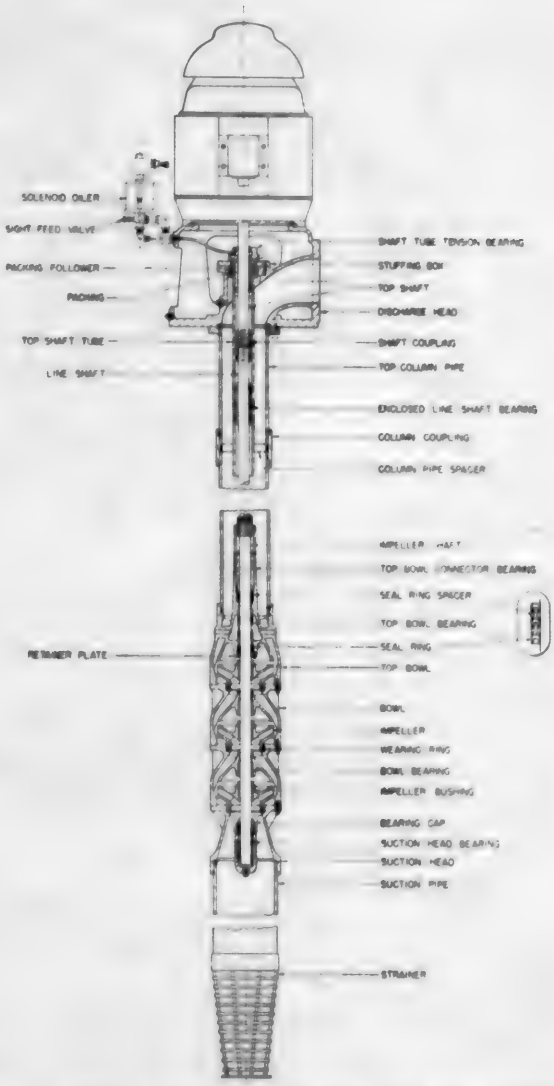


Fig. 1. Section of vertical turbine pump with closed impellers and enclosed line shafting for oil lubrication.

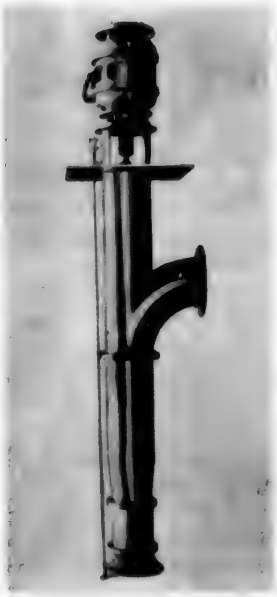


Fig. 2. Vertical propeller pump.

parts as well. For these two reasons, the hollow shaft type of motor or gear is most generally used for vertical turbine pump drive. In addition to the hollow shaft motor or gear drive, these pumps are often made with their own thrust bearings for belt drive and for drive through a flexible coupling by a solid shaft motor, gear or turbine. Dual driven pumps generally employ a combination of an angle gear with a vertical motor mounted on top of the gear.

Structurally, the design of vertical pumps illustrates how a centrifugal pump design can become specialized to meet a specific application. Fig. 1 illustrates one design with closed impellers and enclosed line shafting for oil lubrication. Another design features closed impellers and open line shafting for water lubrication.

The bowl assembly or section consists of the suction case (also called suction head or inlet vane), the impeller or impellers, the discharge bowl, the intermediate bowl or bowls (if more than one stage is involved), the discharge case, the various bearings, the shaft, and the various miscellaneous parts, such as keys, impeller locking devices, etc. The column pipe assembly consists of the column pipe itself, the shafting above the bowl assembly, the shaft bearings, and the cover pipe or bearing retainers. The pump is suspended from the driving head, which consists of the discharge elbow (if above ground discharge), the motor or driver support, and either the stuffing box, in case of open shaft construction, or the assembly for providing tension on the cover pipe and for providing the introduction of lubricant to the cover pipe. In case of below ground discharge, the discharge is taken from a tee in the column pipe and the driving head functions principally as a stand for the driver and the support for the column pipe.

In a vertical turbine pump the liquid is guided into the impeller by the suction case or head. This may be a bell mouth or a tapered section for attachment of a conical type strainer or a suction pipe.

Semi-open and closed types of impellers are both commonly used. For proper clearances in the various stages the semi-open type requires more care in assembly on the impeller shaft and requires more accurate field adjustment of the vertical shaft position in order to obtain the best efficiency. In addition, enclosed impellers are favored over semi-open since wear on semi-open impellers reduces capacity which cannot be restored unless new impellers are installed. Normal wear on enclosed impellers does not affect impeller vanes, and worn clearances may be restored by replacing wearing rings. The thrust produced by open impellers may be as much as 150% greater than enclosed impellers due to the relative unbalanced thrust characteristics of the two styles.

Occasionally in power plants, especially in cases where a unit is being installed in an existing plant in a space originally allotted for a smaller size unit, the maximum level that can be carried in the condenser hotwell will not give adequate net positive suction head for a conventional horizontal condensate pump mounted on the basement floor. To build a pit for a conventional horizontal condensate pump or a vertical dry pit type in order to provide sufficient submergence would involve considerable expense. In such cases a vertical turbine pump mounted in a tank (often called a can) sunk into the floor may be used. The length of the pump has to be made such that sufficient net positive suction head is available for the first stage impeller design, while the diameter and length of the tank has to allow proper flow down the space between the pump and tank and then turn and flow into the bell mouth. The installation of such a design in an existing plant is naturally much less expensive than making a pit, as the size of the hole necessary to install the tank is much smaller. This same basic design has found some application in cases of pumps handling volatile liquids where the layout of equipment does not provide sufficient net positive suction head for pumps mounted on the operating floor.

Vertical Propeller Pumps

Originally the term, vertical propeller pump, was applied to vertical wet-pit diffuser or turbine type pumps using propeller or axial flow type impellers, usually in-

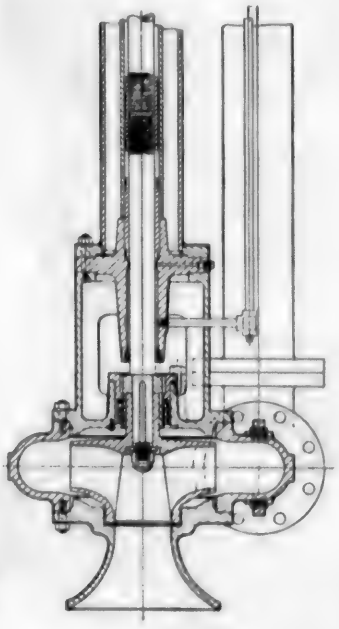


Fig. 3. Section of vertical wet-pit sewage or non-clogging type pump.

stalled in an open sump and having a relatively short setting. For operating heads in excess of those which can be met with a single stage axial flow impeller, two or more stages might be used or a single stage lower specific speed type of pump with a mixed flow impeller might be used. If the operating head is high enough, a pump with mixed flow impellers in two or more stages might be used. For lack of a suitable name, these higher head designs have been more or less generally considered as in the propeller pump classification.

While vertical turbine pumps and vertical modified propeller pumps are basically the same type and hydraulically could be of the same specific speed, a basic turbine pump design would be one that could have a large number of stages, while the modified propeller pump would be of a mechanical design basically intended for a maximum of two or three stages.

Most of the wet-pit drainage, low head irrigation and storm water installations employ pumps of the conventional propeller (Fig. 2) or modified propeller type. There has been some application of this type of pump for condenser circulating service; however, a specialized design has been primarily used for this field. Large power plants generally are located at centers of population, and as a result usually have to use badly contaminated water, both fresh and salt, as a cooling medium. With such water a fabricated steel column pipe and elbow would give short life, and cast iron, bronze, or even a more corrosive resisting cast metal must be used. This results in a very heavy pump when large capacities are involved. To avoid the necessity of lifting this large mass when the rotating parts need maintenance, some designs are built so that the impeller, diffuser and shaft assembly can be removed from the top without disturbing the column pipe assembly. These designs are commonly designated as of the pull-out type.

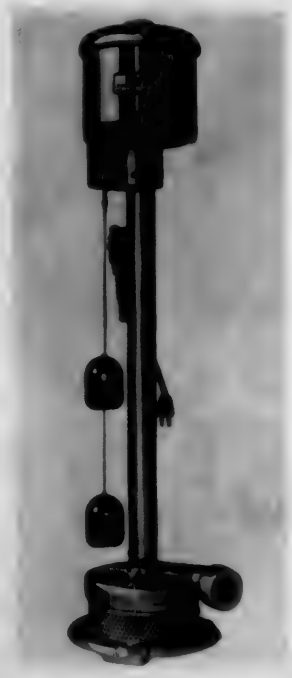


Fig. 4. Typical cellar drainer sump pump (Starite photo).

Like vertical turbine pumps, the propeller and modified propeller pumps have been made with both open and enclosed line shafting. Except for condenser circulating service, the enclosed type, using oil as a lubricant and with a grease lubricated tail bearing below the impeller, seems to be favored. For pumps handling condenser circulating water, some designs use enclosed type shafting, but with water, often from another source, as a lubricant, thus eliminating any possibility of oil getting into the circulating water and coating the condenser tubes.

Propeller type pumps have open type propellers. The modified propeller pumps with mixed flow type impellers are made with both open and closed impellers.

Wet-Pit Sewage Pumps

Except for some large vertical propeller type pumps handling dilute sewage (basically storm water contaminated by domestic sewage) vertical wet-pit sewage pumps are of the bottom suction volute type with impellers capable of handling solids and stringy materials with minimum clogging (Fig. 3). This type pump is usually suspended from a higher floor by means of a drop pipe and often employs covered or enclosed type shafting as used in vertical turbine pumps. They are provided with a bell mouth suction inlet and changes in bearing and stuffing box construction. Otherwise, these pumps are usually hydraulically and mechanically similar to their dry-pit counterparts.

Three basic constructions have been used for this type of pump. The first, used with impellers without back rings, employs a water or grease lubricated bearing with a seal at its lower end, immediately above the impeller, and with the upper end vented to the suction pit to prevent any appreciable hydraulic pressure on the seal at the lower end of the shaft cover pipe; otherwise water will work into the cover pipe. The seal at the lower end of the impeller bearing must be effective, especially with the high pump heads; otherwise there is considerable leakage of water through the bearing, with some cutting if grit is present in the liquid. A second construction is similar, but employs pump out vanes or wearing ring joints on the back side of the impeller (the latter necessitating balance holes through the impeller hub), so the bearing is subjected only to suction pressure. A third type of construction, used primarily with impellers having no back rings or pump out vanes, retains a stuffing box in some form, with bearings above the stuffing box and separated from it.

Limitations

While shaft seals and packing used to seal the lower end of the cover pipe or bottom bearing are intended to exclude water as much as possible, some leakage of liquid with higher suction water levels is to be expected even when the seal is new. Some of the shaft bearings may have to operate in water or in a mixture of oil and water, so the bearing may wear relatively faster than one positively lubricated with oil or grease. In general, wet-pit sewage pumps should be limited to services requiring operation for a very limited period of the day.

In addition to the more common wet-pit sewage pumps, there have been various installations of volute pumps; some single suction, with either bottom or top suction;

and others double suction, supported on the pit floor. Except for some floating dry dock installations, this type of pump has little modern application.

Sump Pumps

The term sump pump generally conveys the idea of a vertical wet-pit pump, usually motor-driven, suspended from a floor plate or sump cover, or supported by a foot on the bottom of a well and autmatically controlled by a float switch. The term does not indicate any specific type of construction, as both diffuser and volute type, single or multi-stage, with open and closed impellers of a wide range in specific speed type, have been employed for this service.

For the very small capacity field, where fractional horsepower motors can be used, cellar drainers can be obtained. These are small, usually single-stage volute pumps, with single suction impellers, either bottom or top suction, supported by a foot on the casing, with the motor supported some distance above by some form of a column enclosing the shaft. Such cellar drainers are made as complete units, with float, float switch, motor and strainers completely assembled as a unit (Fig. 4).

Larger capacity sump pumps may be of the vertical propeller or turbine pump type (single or multi-stage), or of the vertical wet-pit sewage or volute type. Where solids or other waste materials may be washed into the sump, the vertical wet-pit sewage type pump with a non-clogging type of impeller is preferred for such sump pump service.

The larger capacity sump pumps are usually more or less standard designs, but obtainable for any length, with various size sump covers, float switch mounted on the sump cover, etc. Often duplex units, that is, two pumps on a common sump cover, possibly with a manhole for access to the sump, are used (Fig. 5). Such duplex units could have the pumps operate in a fixed order or a mechanical or electrocal alternator could be used to equalize the operation of the two pumps.

Fig. 5. Typical duplex sump pump (Economy photo).

Applications

The vertical wet-pit pump has, like all other pumps, advantages and disadvantages, the former being mostly hydraulic and the latter mechanical. With the impeller, or first-stage impeller in case of multi-stage pumps, submerged, there is no priming problem, and the pump can be automatically controlled, with no concern that the unit will ever run dry. Also, the net positive suction head, in cases other than a closed tank, is greater, often permitting a higher rotative speed for the same service conditions. The only mechanical advantage is that the motor or driver can be located any desired distance above any flood level. The mechanical disadvantages are: possibility of freezing when idle; possibility of damage by floating objects; inconvenience of pulling and dismantling for inspection and repairs, no matter how small; and, finally, relatively short life of the pump bearings unless the water conditions and bearing design are ideal. The vertical wet-pit pump is the best for some applications; not ideal, but most economical for other installations; a poor choice for others; and lease desirable for still other cases.

Next month—bed plates and supports.

Rubber Lining Prevents Rusting of Metal Piping

A British automobile manufacturer recently conducted an experiment of interest to all plants using water for processing, cooling, or other purposes.

In this particular instance the water was drawn from boreholes and was brackish and estuarine in character. The presence of salt and other impurities in only eight months of service caused rusting right through the walls of the unlined steel pipes.

New pipes were installed, also unlined. The failure repeated in about the same interval. After the second failure it was decided to experiment with a rubber-lined pipe. The installation was made in the summer of 1948.

Today, with over six years of constant service under the same negative conditions, the rubber-lined main is in excellent condition, according to a report from the Natural Rubber Bureau, Washington, D. C.

PIPING

Plumbing Codes

AMERICANS enjoy a standard of living conditions and sanitary facilities that are not equalled in any other country. This high standard has been achieved only through the combined efforts made in many fields, including advancements through engineering and research by the plumbing industry.

Plumbing has really made outstanding forward steps. A large measure of this is due to manufacturers who are alert to the need for designing new fixtures and equipment to keep pace with changes brought about through improved building design and construction, and by changes in living conditions and needs.

Code Requirements

With the installation of sanitary piping and fixtures within the confines of a building, it became necessary for municipalities and other government bodies to pass regulations which ensured that such installations were so made that public health was not endangered and that the systems would function properly for many years. These regulations were the nucleus of what we now term the plumbing code which concerns itself with the installation of fixtures, equipment and piping. Since these regulations represented the best standards and practices of the time, members in the industry were requested to follow the rules as good plumbing practice.

Each city and town set up codes to meet individual requirements. As the cities grew and changes were made in the scope of plumbing, it became the responsibility of the municipalities to modify and expand their codes. Local plumbers who worked largely in their own community, had no difficulty in learning the local code and keeping abreast with the changes.

Present-day Plumbing Systems

Plumbing systems have become more complex with the passing of time and the development of new ideas. Also, plumbing is now a specialized branch of engineering and is taught in some of the major colleges.

Plumbing has increased in scope to include the different types of fixtures, varied methods of installation and components of sanitary, storm, water, gas, fire protection and other related systems, all of which fulfill the desired functions and needs of a building or project.

The design and installation work, however, are still subject to code requirements of the local area in which the project is to be erected. As mentioned, each city and town has prescribed minimum code requirements to be followed by the engineer and the contractor.

The interpretation of the code and the inspection of the work is usually delegated by the authorities to an organized plumbing department, building department, health department, city engineer, physician or other persons selected for this responsibility. The objective is to insure that the plumbing work will be properly installed and in a manner that satisfies the local code.

Engineering Design

Engineers who design plumbing systems do not have too much difficulty when their design work is confined to projects for their own city or town. It generally takes but a short time to become acquainted with the local code and its interpreation or modifications. However, engineering work is no longer confined to a specific area. Instead, an engineer may be called to design plumbing systems for a project to be erected in almost any part of the country. The site of the proposed project may be within the limits of a large city, small city, town or other area, but regardless of the location, the design must conform to the code followed in that particular area. It is at this point where design problems are encountered.

Various Codes

Plumbing codes vary considerably from several pages to a book of more than a hundred pages and often must be purchased. The price may range from $.50 to $1.50, depending upon its size and scope. Quite often the code is included in a general construction book for which the cost is $3.50 or more. Since the code will govern the work, a copy must be obtained before the design work is started. Sometimes it is impossible to secure a copy of the code, particularly in small towns, because it is out of print or is in the process of being revised. It is then necessary to receive verbally code requirements from the person or persons responsible for the inspection and approval of the plumbing work. This transaction is both time consuming and haphazard, and can lead to serious difficulties during the design or construction stages.

Many of the present codes, especially those of small cities and towns, are based on plumbing conditions, pertaining to the home or small buildings and are not adequate for larger projects. During the past 10 years, new

construction work has reached an all time high. Many hospitals, schools and other large projects are now being erected in areas where the scope of the code is greatly exceeded by the work performed. Decisions concerning the plumbing design must then be made by the responsible authority. Unless this person has had experience on similar projects, it would be rather difficult for him to offer a ruling. The result is that the engineer usually ends up following a more suitable code or will follow his own judgment. In either event there is a great margin for misunderstanding with the local authorities.

Interpretation of Codes

Interpretation of the various codes can be rather trying, since but a few of the many existing plumbing codes are found to be alike. Some of the codes are not even similar and often codes of two adjoining small towns will be completely different.

In larger cities, the codes are found to be fairly similar with reference to the subject matter covered. Yet these codes will differ in their definitions of the basic plumbing terminology, or in the value of the fixture unit equivalents. This difference and the difference in requirements for the design or installation of the plumbing systems can be explained by saying that the requirements of one particular area are a bit more unusual than those of other areas. However, only certain basic principals of physics and hydraulics, determine the manner in which a plumbing system will function. These are proven methods based on experiments performed in research laboratories.

Most unfortunate is the fact that even the codes of some of our largest cities are not up-to-date or they are not entirely correct in their requirements. Due to differences and the out-dated requirements found in codes, an engineer can spend considerable time in just obtaining the correct interpretation of the code that he finds necessary for his design work.

Revising a Plumbing Code

It may be of value at this time to discuss the manner in which some of the present codes are revised and issued.

State Code. In many of our states a group of men, or just one man is commissioned by the authorities to revise the plumbing code to suit the changing requirements of the area it covers. Those chosen are generally specialists capable of producing an adequate code. If, however, the persons are not too well versed in the subject, they must seek the guidance of persons qualified in the plumbing field. When this occurs, the code is often out-dated by the time it is ready for publication.

City Code. Depending upon the size of the city, the revising of the plumbing code is generally handled in a manner similar to that described for the state, with the same results.

Town Code. Codes in this group are by far the more numerous, for obvious reasons. A town usually cannot afford to spend any sizable amount of money to revise its code. Therefore, many of these existing codes are often years behind the times and certainly do not contain, within their scope, the necessary requirements for large construction projects. Those selected for revising the code are in most cases, local citizens who are not aware of the newest developments or hazards encountered in the plumbing industry.

Louis Blendermann, who conducts the department "Piping and Plumbing" is now director of engineering for the Plumbing Division of J. A. Zurn Mfg. Co., Erie, Pa. He will have complete charge of the engineering responsibilities in the design, manufacture and installation of Zurn systems, drains, hydrants, interceptors and related products. He has a wide experience in the design of plumbing and piping, extending back to 1936 when he worked as a mechanic for a plumbing contractor. He later became a designer and supervisor of plumbing and piping for a naval architectural firm. From 1946 to 1950 he served as chief engineer of the plumbing department of Voorhees, Walker, Smith & Smith, consulting engineers of New York. He then was in charge of the plumbing work for the New York branch of Smith, Hinchman & Grylls of Detroit, Mich.

These methods of making changes fail to provide a concise and streamlined code that will assure the highest standard of design and construction. A loose, unrelated code of doubtful value is the result.

National Plumbing Code

The solution to these varied and conflicting codes is obviously a clear and precise National Plumbing Code. National unity of design has been established in the heating and air conditioning industry to a great extent. The National Electric Code helps to set the standard for the electrical industry. It seems possible, similarly, that a national code would benefit the plumbing industry.

Although this is a delicate subject that has been often discussed, it is the sincere wish of every engineer that such a code be adopted.

There are certain problems that at first appear unsurmountable when consideration of a national code is discussed. A few of the problems follow:

1. If a national code were to be adopted, it would be necessary to select an organization or group to prepare it and thereafter to keep it up-to-date with the newest trends and requirements. However, since there are at present several proposed national plumbing codes of unmatched value, it should not be too difficult to choose one for adoption.
2. Various states, cities and towns feel that there are certain problems or conditions peculiar to their special area that is different from other areas. This feeling is realized and respected. However, these supposed differences have been examined and it can be reported, that they are relatively small in proportion to the overall magnitude of the plumbing system and can be resolved.
3. Then there is a concern that the code should not be changed too quickly because of the impositions placed on existing structures or new structures being erected. This condition is not a local one but is a national one and would be handled as such.
4. Finally, there is a doubt as to why a small city or town should be subject to the same code requirements as a large city, especially since the scope of the construction work is on a smaller scale. The contents of the several proposed national codes apply to all projects, both large

(*Concluded on page* 170)

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard on page 142 for securing additional information on items described in this department.

Built-In Room Coolers

A technique for air conditioning apartment houses that combines features of centralized systems and window-type room coolers is announced by Airtemp Div., Chrysler Corp., Dayton, Ohio. The system utilizes independently operating, individual room units built into the exterior wall, and operates independently of the heating system.

The individual units do not project beyond the outside of the building (upper photograph) and are virtually flush with the inside wall (lower photograph). They are being made in ½, ¾, and 1-hp sizes.

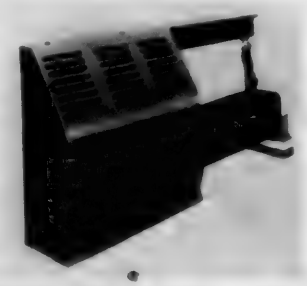
On brick construction the unit extends approximately 5-in. into the room. With thicker wall construction, the sleeve depth must be extended. However, the units all have the same dimensions and are interchangeable with each other.

The mounting sleeve is made of 16-gage galvanized steel and the outside louvered grille, which is attached to it, is made of anodized aluminum. Installing mounting sleeves in new installations makes it possible to add the room air conditioners later or to change the location of individual units if necessary.

More information? Circle Item 1 on postcard, page 142.

Radiator Enclosures

Enclosures for fin pipe radiation are being made by Stedco Products, Wilkes-Barre, Pa.



For steam or hot water heating, the enclosures, called Thermo-Lux, are recommended for use in schools, offices, hospitals, or commercial or institutional installations. They are available for single, double, or triple tier installations, and will accommodate 15 sizes and capacities of the company's radiators.

The enclosures use a wall bracket for mounting and adjusting the sliding hangers and a rubber gasket seal between the hanging strip and the enclosure.

More information? Circle Item 2 on postcard, page 142.

Cast Iron Industrial Fans

Cast iron fans, for industrial applications, are available from Sturtevant Div., Westinghouse Electric Corp., Boston, Mass. The fans will handle wood shavings, chips, granular material, textile fibers, asbestos, rags, powders, dust, gases and fumes.

For specific applications, any of four different wheels or three drive arrangements can be selected. Protective accessories and coatings are available for high temperature and extreme abrasion installations.

This redesigned series of fans features a range of wheel diameter sizes from 8¼ to 34½ in. and inlet pipe sizes from 4½ to 18 in. Their air volumes range from 150 to 12,000 cfm.

The fan housings are convertible to all normal discharge directions and are also reversible.

More information? Circle Item 3 on postcard, page 142.

3 Pump Sizes Added to Line

Three sizes are added to the Centri-Thrift line of centrifugal pumps manufactured by the F. E. Myers & Bro. Co., Ashland, Ohio.

The sizes added are 1½, 2, and 3 hp. Previous models included ⅓, ½, ¾, and 1-hp sizes.

The pumps are available in motor-mounted or belt-driven models with heads up to 135 ft and capacities up to 90 gpm. They can be used with air conditioning and laundry equipment for hot and cold water circulation, booster service, cooling systems, and other water transfer jobs.

More information? Circle Item 4 on postcard, page 142.

Five Gas Controls in One

A gas heater control, the Model 55 Gasapack, has been developed by A-P Controls Corp., Milwaukee, Wis. The unit is comprised of five controls, namely a built-in pressure regulator for city gas; a pilot filter; an automatic pilot, and main and pilot shutoffs.

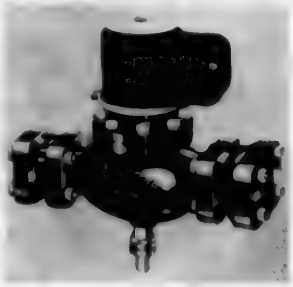
Three automatic accessories to the control include the 55 MTS modulating snap thermostat, the 55MT modulating thermostat and the 55ET electric thermostat.

The control has a standard thermo-magnetic Safety pilot, with a safety shut-off. Listed by the AGA, the unit has bypass or low fire adjustments.

More information? Circle Item 5 on postcard, page 142.

Refrigerant Piston Valve

A flange-type, magnetically-piloted piston valve for high capacity refrigerant control is being produced by General Controls Co., Glendale, Calif. Because of its piloted action, the valve is capable of handling large capacities with a minimum pressure drop, and is useful for both liquid and suction appliances.



Called the K-15F series, it is made in 4 basic sizes, ranging from 150 to 250 psi.

Flange connections facilitate its installation and companion flanges permit its installation in 1 to 2-in. pipe sizes or welds, and in 1⅜ to 2⅝-in. OD tube sweat fittings.

The main valve is held open electrically. No pressure drop is required to hold it open. This is an advantage in refrigeration applications, particularly in the case of suction pressure. The valve closes upon current failure, but has a manual opening device for emergency use.

The valve can be used on either liquid or suction lines and has a moisture resistant coil processed to withstand the formation of condensation and ice.

More information? Circle Item 6 on postcard, page 142.

Additives Price Reduced

A reduction in the price of Fuel Oil Additive No. 2, a product which prevents filter clogging in furnace and diesel oils, is announced by E. I. duPont de Nemours & Co., Wilmington, Del.

The new fuel oil additive price, the result of an expanded market for the company's Petroleum Chemicals Div. product, is down $.08 to $.60 per lb by tank car shipment. The carload drum price is $.63 per lb, compared to the former price of $.69, and the price for less-than-carload drum lots is down $.06 to $.64.

More information? Circle Item 7 on postcard, page 142.

Liquid Heaters

Grid heaters, named Hi-Therm, for heating solutions in plating, rinsing, cleaning, and caustic tanks, are being produced by Rempe Co., Chicago, Ill.

Fabricated from wrought steel pipe and tested at 350 lb of pressure, the heaters are 31½ in. high and have a cross sectional width of 2¾ in. Their average heat transfer coefficient when heating solutions of water to boiling point is 800 Btu per deg temperature difference, per hr, per lin ft of overall length.

The heaters can be used on the side or bottom of a tank with either horizontal or vertical supply and return piping.

More information? Circle Item 8 on postcard, page 142.

Device Stops Light

A warm air ventilator accessory that retains black out curtains is manufactured by Herman Nelson Div., American Air Filter Co., Inc., Louisville, Ky. Termed the Light/Stop by the company, the accessory is a strip that runs the length of a unit ventilator and retains the lower edge of a curtain, thereby preventing it from billowing out in the ventilator discharge air stream. This eliminates flashing streaks of light that would distract the attention of students in a school, for example.

The curtain accessory allows the unit ventilator to continue its ventilating, cooling, heating, and air diffusion.

The accessory can be installed on the company's existing unit ventilator equipment without modifying either the accessory or the equipment.

More information? Circle Item 9 on postcard, page 142.

Dry Fluid Drive

A new development in industrial power transmission, called Flexidyne, and described as a dry fluid drive, is announced by Dodge Mfg. Corp., Mishawaka, Ind. Originated in Europe, the drive has been redesigned to American standards for industrial drives involving heavy inertia and shock loads on such equipment as compressors, centrifuges, and blowers.

The drive is made up of a housing (upper photograph), inside of which a rotor is free to turn concentrically. Between the two are fine particles of spherical steel shot, called the flow charge, which acts very much like a fluid. It is the flow charge which transmits power from the housing to the rotor.

How the drive works is described by the company as follows: The motor is connected to the housing, and starts it turning at no load. The flow charge is thrown to the circumference of the housing, is compressed by centrifugal force, and revolves with the housing. The rotor, connected to the load, is started and accelerated by the friction and wedging action of the revolving flow charge. The rotor and housing then reach the same speed.

The amount of the flow charge used determines the torque capacity. The units are available as drives and as couplings in 4 sizes rated for 3 to 30 hp at 1800 rpm.

More information? Circle Item 10 on postcard, page 142.

Pipe Insulation Slips On

The development of a foamed plastic pipe insulation for use on dual temperature lines to air-conditioning units is announced by Armstrong Cork Co., Lancaster, Pa.

Called Armaflex, the material is available in tubular form. It can be slipped on pipes or tubing when the system is being installed. If the lines have been connected and tested, the insulation can be cut to the desired length, slit longitudinally, snapped on the line, and the slit sealed with an adhesive which is available with the material.

Because it is a closed-cell foam that is resistant to the passage of vapors and air, it does not require a vapor barrier. The thermal conductivity of the material is approximately the same as corkboard. It will withstand temperatures on dual-temperature lines or tubing from 32 to 200 deg.

Other characteristics of the material are low air and water vapor permeability, low water absorption, and high temperature stability. It is self extinguishing in that combustion ceases when there is no direct contact of the material with a flame. The ½-in. wall thickness of the material will prevent condensation caused by climatic conditions normally experienced in the United States.

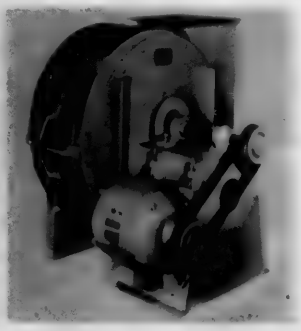
It is made in 6-ft lengths in four sizes to fit the sizes of pipe commonly used in dual-temperature heating and cooling system installation. The four sizes made are ⅝, ⅞, 1⅛ and 1⅜-in.

More information? Circle Item 11 on postcard, page 142.

Induced Draft Fans

Packaged fans, called Spid, for oil, gas, and coal-fired boilers, in sizes up to 350 hp and 650 deg F, are available from Chicago Blower Corp., Franklin Park, Ill.

The unit includes the fan, motor, motor base, and an adjustable V-belt drive for boiler requirements ranging from 4500 to 50,000 EDR. They will support 30 ft of ⅛-in. gage steel stack if properly braced with guy wires. The front and back plates are interchangeable and are bolted to the housing.



Self-aligning, ball bearing pillow blocks are used to support the cast aluminum drive shaft. Wheel diameters from 15½ to 48½ in. are made for the units, and the motors are furnished with or without controls.

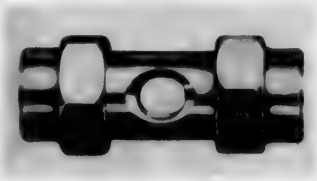
Bulletin SI-101, published by the company, gives detailed information about the fans.

More information? Circle Item 12 on postcard, page 142.

Refrigerant Indicator

A liquid eye refrigerant indicator for installation in the piping of air conditioning refrigerating units is a products of Allin Mfg. Co., Chicago, Ill. Designated the 3000 series, it complements the company's solder-type, 2000 series indicators.

The eye of the indicator is a thick Pyrex glass mounted in a cadmium-plated steel housing that protects it against external damage, shock, or line stresses. Its gasket joint is sealed by springs with the assistance of fluid pressure.



Each unit is tested at pressures in excess of normal operating conditions and periodic hydraulic tests of 1000 psi are made to guarantee the safety factor of the glass under extreme operating conditions.

The indicator can be used on ammonia or Freon systems and is available with one left-hand and one right-hand thread on special order.

More information? Circle Item 13 on postcard, page 142.

Valve Sizes Are Revised

A revision to its automatic reducing valves, for the control of water pressure, is made by Klipfel Valves, Inc., Hamilton, Ohio.

The No. 700 reducing valve is now available in sizes from ½ through 4 in. for initial pressures up to 300 psi, and for delivery pressures from 10 to 75 psi. It is suitable for supplying low or medium water pressure to buildings from high pressure city water mains.

Other types of reducing valves are available from the company in sizes from ⅛ to 10 in. in both direct and pilot-operated models to meet individual requirements. Self-cleaning, Y-type, pipeline strainers in sizes to 6 in., for the protection of the valves, are also available.

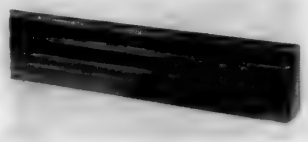
The details of the valves' construction and specifications are contained in Bulletin No. 154.

More information? Circle Item 14 on postcard, page 142.

Matching Return Air Grille

A return air grille for perimeter baseboard installations is announced by Air Control Products, Inc., Coopersville, Mich.

The grille, designated No. 186, has been designed to provide a matched installation with the firm's No. 180 baseboard perimeter diffuser. It is available in 4-ft sections and has a free area of 58.72 sq in.



The grille requires no stackhead, and eliminates the need for cutting an opening in the wall. The bottom of the unit has knock-out sections for duct installation, and can be installed on rough or finished floors, either before or after plastering.

More information? Circle Item 15 on postcard, page 142.

Foam Insulation Sprayed On

A resinous liquid that is sprayed on like paint and foams to 20 times its original thickness is being produced by Insul-Mastic Corporation of America, Pittsburgh, Pa., as a spray-on insulation known as Poly-Cell.

The advantage of this type insulation is that it can be used to insulate irregular surfaces such as valves, fittings, and flanges without the use of bands, welded studs, or wires.

The insulation can be applied at any desired thickness in one coat by varying the amount of liquid originally sprayed. The company, however, recommends ½ to 1 in. as the most economical thickness. The number of square feet covered by one gallon of the material varies with the thickness to be obtained. Nevertheless, one gallon of the liquid when sprayed over 100 sq ft will foam to a thickness of ⅜-in.

The material's K factor per inch of thickness is 24. It weighs slightly more than 2 lb per cu ft, and its high temperature limit is 225 deg F. The lowest temperature at which it has been tested so far is –40 deg.

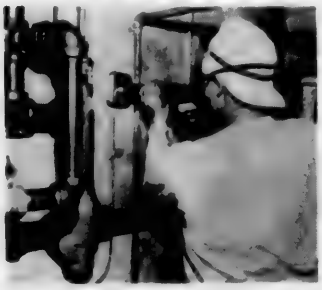
More information? Circle Item 16 on postcard, page 142.

.25 Caliber Drive Tool

A high-powered, light-weight, powder powered tool for use in residential to heavy construction projects is available from Powder Power Tool Corp., Portland, Ore.

The tool is called the Creary Drive-It 330, is less than 6 lb in weight, and is 13 in. in length. It is powered by a .25 caliber drive and is also adaptable to a .38 caliber drive but can handle nearly all jobs with the lighter caliber.

The tool has a snap-open breech action (upper photograph) with an automatic cartridge extractor, a molded rubber pistol grip and foregrip; the rest of the tool has a polished chromium finish. It can be field-stripped into 3 segments for cleaning. Though the company recommends two-handed use of all its power tools, this model can be used with one-hand where it is physically impossible for a workman to use two. It comes packaged in a portable steel case with accessories.



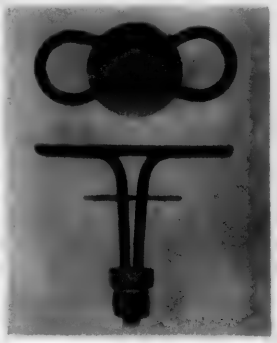
The tool uses 56 different sizes and kinds of drive pins that make it applicable to electrical construction, plumbing (lower photograph), heating, and ventilating work, plastering, wood, steel, and general construction.

Literature about the tool and a description of the pins, applications, pull out loads, vibration tests, tensile, and shear strengths are available from the company.

More information? Circle Item 17 on postcard, page 142.

Infra-red Heating Elements

Two metal infra-red electric heaters, named Metaray, are being made by Edwin L. Wiegand Co., Pittsburgh, Pa., for industrial baking, drying, curing and dehydrating operations.



One type is equipped with a standard medium screw base, the other with bi-post terminals. Both the heaters are sheathed in Inconel in order to resist the vibration and shock of industrial installations. The elements are self-cleaning, in that splashed liquids and other materials are burned off.

The heaters can be cycled or pulsed by an input controller, so that the radiation can be adjusted to fit the speed of conveyers or the size of the work. This control can be dialed in the same fashion as the volume control of a radio.

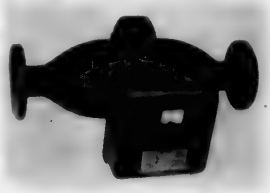
Both infra-red elements are insulated for safety, and are available in ratings from 375 to 1200 watts for 120 and 240 v operation.

More information? Circle Item 18 on postcard, page 142.

Water Scale Controller

A device for controlling hard water scale formation in boilers and heat exchange equipment by non-chemical means is produced by Heller Laboratories, Leonia, N. J. The capacity of the units, called Hydroton, has recently been increased by 20% and their prices in comparable sizes have been reduced.

The process employed by the equipment changes the manner in which minerals are deposited from water solutions. Instead of the minerals depositing as a hard, dense, cement-like coating, they are deposited by the unit as a fine, loose sludge or slurry that can be removed by normal blowdown.



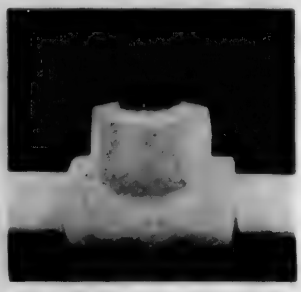
Using no water softeners or chemicals, the process is suitable for treating water for boilers that produce steam for food or other processing where there is danger of contaminating the products with chemicals. It is also suitable for treating once-through cooling systems where treatment costs with chemicals are prohibitive.

Among the several applications of the unit are boilers, evaporators, condensers, hot water supply systems, cooling systems for air conditioning, and other heat exchange equipment.

More information? Circle Item 19 on postcard, page 142.

Insulating-Finishing Cement

A white insulating-finishing cement, made of fibers of spun mineral wool, is announced by Baldwin-Hill Co., Trenton, N. J.



Called Super Powerhouse cement, the material provides both insulating properties and a white finish when applied alone or over regular insulating cement, block, blanket, and other forms of thermal insulation. When applied as the only insulating material on valves, flanges, fittings and other irregular surfaces the cement provides a white finish which blends with adjoining white insulations.

The cement can be used to temperatures of 1700 deg F and has a glazed white surface when finished troweled.

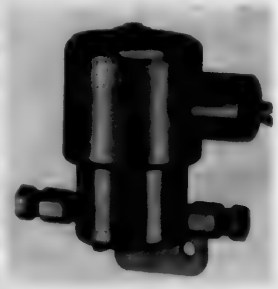
It is an hydraulic-setting material that remains workable for one hour, and sets to initial hardness within two to three hours. It will withstand rain after the initial set. One hundred pounds of the cement will provide a surface ¼-in. thick over an area of 110 sq ft. For finish coats ¼ to ½-in. thick, the linear drying shrinkage is negligible.

The cement is available in 50-lb bags.

More information? Circle item 20 on postcard, page 142.

Solenoid Valve Is Available

An electro-pneumatic valve has been developed by The Powers Regulator Co., Skokie, Ill. The valve's spring, armature, and guide tolerances and material specifications are closely held to prevent alternating current hum.



When energized, the valve passes air at supply pressures up to 25 psi. When de-energized, the supply port is stopped and the return line pressure is wasted to the atmosphere. A built-in manual adjustment permits opening of the valve when the coil is de-energized.

The port connections are ⅛-in. NPT. The valve can be supplied for 115, 208, 230 or 440v, 60 cycles and 12-in. long electrical leads come from a housing which can be rotated to facilitate wiring.

Bulletin 359 and drawing 1255 are available.

More information? Circle item 21 on postcard, page 142.

Extra Strength Castable

A New Equipment item on page 126 of the March issue describing Hydrecon 186 refractory castable, manufactured by J. H. France Refractories Co., Snow Shoe, Pa., contained several typographical errors. The temperature specifications listed in the article were 245, 235, 200 and 245 deg F. They should have read 2450, 2350, 2000 and 2450 deg F, respectively.

Soldering Gun Has Spotlight

Soldering guns with spotlights, no moving parts, and no heavy transformers are being produced by Garden City Industries, Inc., Chicago, Ill. The soldering guns are made in three models, namely, 212LT (illustrated), 214LTN, and 214T.

Models 212LT and 214-LTN have the spotlights and interchangeable tips and element assemblies. This interchangeability of parts provides a wattage range of 650 maximum to 150 minimum. The wattage range is regulated by what the manufacturer calls the thermostatic brain. This feature of the soldering guns is intended to maintain constant heat and extend the service life of the units.

All the soldering guns have steel-clad tips and operate from either a-c or d-c outlets. They are UL approved and are made by the manufacturer to meet government specifications.

More information? Circle Item 22 on postcard, page 142.

Fans Have Wood Blades

Plastic-impregnated wood blades are available on 14- to 22-ft heat exchanger fans manufactured by Hartzell Propeller Fan Co., Piqua, Ohio.

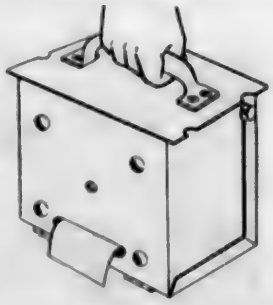
The fans are made with a tapered blade which is considerably thicker at the shank than at the tip.

Introduced to supplement the company's line of plastic cooling tower and heat exchanger fans, the wood blades have a lower initial cost than the plastic blades, which are still recommended for maximum durability.

More information? Circle Item 23 on postcard, page 142.

Time Recorder Is Portable

A time recording device, the Recorder-Totalizer, for recording the operational periods of burners, air conditioners, and other machines is available in a portable model from Heat-Timer Corp., New York, N. Y.



Similar to the company's previous models, the portable unit records, on a paper tape, the length of on and off periods of operation while simultaneously adding the total on, or operational, time of burner. The total operational time is shown on the left face of the recorder.

The purpose of the portable model is to enable heating, ventilating, and air-conditioning servicemen to check the efficiency of the installations they have made or are servicing. Recorders for permanent installation are still being manufactured by the company.

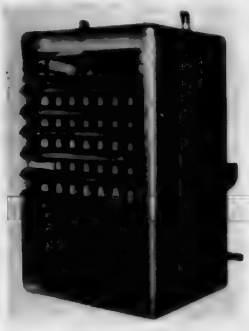
More information? Circle Item 24 on postcard, page 142.

Cast Iron Gas Fired Boilers

Cast iron gas fired boilers, type AO, for operation with natural, mixed, manufactured, and propane gases are manufactured by Worthington Corp., Harrison, N. J. The boilers are made for residential and industrial heating requirements, and are fired by drilled-port cast iron burners.

The boilers for residential uses (upper photo) range in size from a 3-section, 54,000 Btu per hr input to a 15-section 378,000 Btu per hr input for all gases.

The industrial boilers, type BA, are made in sizes from 6 sections with 350,000 Btu per hr input to a twin 31-section boiler with 4,200,000 Btu per hr input for city gases. Each boiler consists of right and left-hand sections and a varying number of intermediate sections. They are assembled and tested at the factory and are shipped knocked-down. The sections have ribbed flue construction.

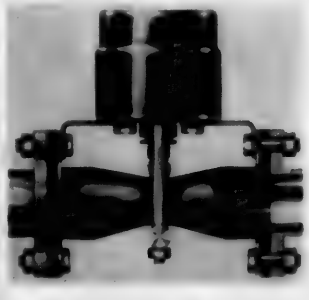


The company is also manufacturing a direct gas fired suspended unit heater type AF, (lower photo). They are available in 9 sizes ranging from 25,000 to 225,000 Btu per hr input capacities, and can be arranged singly or in batteries to handle a variety of space heating jobs. They are approved by AGA for use with natural, manufactured, mixed, or propane gases.

More information? Circle Item 25 on postcard, page 142.

Automatic Pinch Type Valves

Flange valves for handling corrosive materials or abrasive slurries, wet or dry, are available from R. K. L. Valve & Mfg. Co., Philadelphia, Pa. The valves are the straight-through flow pinch type, consisting of a flanged rubber body and a self-supported air-operated pinching mechanism.



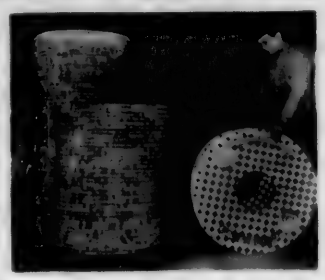
The series Rx, for high pressures, and Rz, for low pressures, valves give bubble tight shut-off and can be obtained either with a positioner for flow control, or without a positioner for on-off service. The rolling diaphragm-type air motor is rated for 125 psi air operation. Valve sizes available are from ¼ through 14 in. for a maximum of 100 psi line pressure and a maximum of 180 deg F operating temperature.

Other valves are available for hand operation.

More information? Circle Item 26 on postcard, page 142.

Tube Is Put in Round Carton

A round-carton for packaging flat rolls of copper water tube, refrigeration tube, and automotive tube is announced by Wolverine Tube, Div. of Calumet & Hecla, Inc., Detroit, Mich.



Designed to save the wholesaler storage space and act as a reel for the installation serviceman, the carton was developed to meet the specific demands of industry for packaging that is easy to stock, easy to inventory, convenient to handle, and sturdy enough to protect the tubing.

The round carton is constructed of heavy corrugated board. The center is open to facilitate hand or over-the-shoulder carrying, or it can be rolled like a hoop to a job site. The outer edge is bound with tape printed with size, type and length nomenclature, and is color coded.

More information? Circle Item 27 on postcard, page 142.

Aluminum Alloy Cutters

Metal cutters with handles made from Frontier 40-E aluminum alloy are introduced by H. K. Porter, Inc., Somerville, Mass.

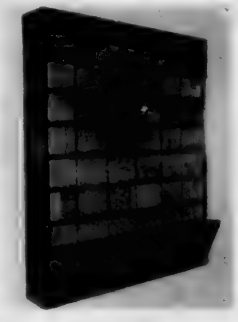
The cutters are manufactured in sizes to cut from 5/16 to ¾-in. round, medium hard steel, with handle lengths from 14 to 42 in. The length of the handles increases as the capacity of the cutter increases.

A decrease in the weight of the cutters is the purpose of fabricating the handles from aluminum. For example, the company's 36-in. cutter with aluminum alloy handles weighs 10½ lb, whereas, its 36-in cutter with malleable iron handles weighs 14¾ lb.

More information? Circle Item 28 on postcard, page 142.

Filter's Width Is Increased

A series of automatic, self-cleaning air filters with a section 6 ft wide is introduced by Continental Air Filters, Inc., Louisville, Ky.



The wider section not only adds flexibility of design to the series, which can accommodate any desired cfm capacity, but will also cut costs in multiple-section installations by reducing the number of sections and, perhaps, drive mechanism units needed.

In addition to its self-cleaning automatic filters, the company produces 2 and 4-in. E. Z. Wash filters, grease filters, and dry-type, synthetic-media Dycon filters for industrial, commercial, and domestic use.

More information? Circle Item 29 on postcard, page 142.

Cooling Tower Has External Sump

Cooling towers, named Flow-Mizer, with capacities from 15 through 100 tons at 75 deg w.b. and a water saving efficiency of up to 97%, are announced by Acme Industries, Jackson, Mich.

Centrifugal blowers are used in the towers to induce constant velocity air flow with ample capacity for use with ductwork, when needed. The wetted metal deck principle of water-to-air heat transfer is employed with the company's Z-design, all-metal cooling pack.

Servicing of the towers has been made more convenient by locating the sump outside the tower. The water treatment basket, the removable sediment screen that can be cleaned, and a combination waste-drain and overflow fitting are reached by removing the sump cover.

Other features of the towers include large access doors, flush-type air inlets, and integrally-mounted, bronze-fitted pumps.

More information? Circle Item 30 on postcard, page 142.

Explosion-Proof Motor

An explosion-proof, fractional horsepower motor, designed for safe operation in hazardous atmospheres, and minimum maintenance, is announced by the General Purpose Component Motor Dept., General Electric Co., Schenectady, N. Y.

For operation in hazardous atmospheres such as dry-cleaning plants, paint factories, and gasoline refineries, the motor is constructed with heavy cast iron end shields for extra protection. Overbolts give the motor assembly additional strength with little increase in weight.

According to the company's engineers, the motor will give 10-years' normal service without relubrication.

The motor has been tested by UL and approved for Class I, Group D; and Class II, Groups E, F and G atmospheres.

More information? Circle Item 31 on postcard, page 142.

Industrial Lining Compound

The application of a corrosion-resistant Neoprene lining compound to fan blades, fume ducts, process vessels, pump impellers, valves, and piping is announced by Pennsylvania Salt Mfg. Co., Philadelphia, Pa. The product, called Pennsalt NeoLine, cures to a resilient vulcanized protective coating for metal, concrete, or wood. It can be heat-cured or air-cured.

One of its features is the flexibility of application. It can be applied equally well to irregular shapes and surfaces and plain surfaces. Its flow qualities permit application by brush, roller, spray or dip methods.

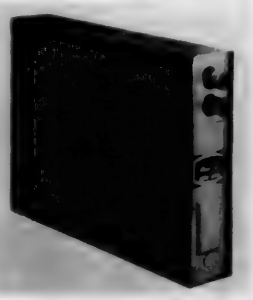
Tests of the material showed its resistance to corrosives at temperatures ranging from —50 to 200 deg. F. Curing accelerators for the coating are packaged separately and are mixed with it just prior to its application. A choice of accelerators is available for various methods of applying the lining.

Among the uses for the product are immersion service in caustic soda and other strong alkalies; salt and brine solutions; acid, alkaline, and neutral salt solutions, vegetable oils and greases, and a variety of other acids and organic compounds.

More information? Circle Item 32 on postcard, page 142.

Automatic Coil Defroster

A holdover plate, the Heat-Cel, which stores heat for defrosting low temperature evaporators, is being made by Dole Refrigerating Co., Chicago, Ill. It can be used on new or existing installations.



A low wattage heater, controlled by a thermostat, maintains the temperature of the solution in the defroster at the point of its maximum defrosting efficiency. The electric heater element makes the amount of heat available independent of such hard-to-control factors as surrounding ambient temperatures, compressor head, or operating time.

Each unit has a kit consisting of a timer, a solenoid valve, and a shut-off valve. The timer is adjustable to give defrost periods ranging from 1 to 24 hr, depending upon the severity of service. A fan delay is also used to prevent the fan from operating when the coil is above freezing.

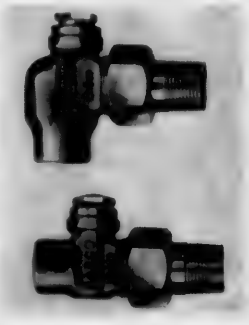
At the present time 3 standard sizes are available, the HC1E, HC2E, and HC3E, for use with 1, 2, and 3-hp, air or water-cooled condensing units.

The defrosters are approved by the Underwriters' Laboratories.

More information? Circle item 33 on postcard, page 142.

Vane-less Balancing Valve

A new type balancing fitting for hot water and radiant systems has been developed by Sarcotherm Controls, Inc., New York, N. Y. The fitting utilizes a segment of a circle instead of the conventional butterfly restriction in order to permit an equal flow with an equal opening.



The solid segment offers no obstruction to the flow when in the fully open position. The fitting is suitable for 200 psi water pressure and is also available with an integral manual air vent.

More information? Circle Item 34 on postcard, page 142.

Paint Protects Metal

A black, anti-rust paint for the protection of exterior metal work is announced by Chem Industrial Co., Brooklyn, Ohio.

Known as CI-88, it consists of a bituminous base and a special paint vehicle combined to produce a heavy-bodied coating which can be applied on outside metal after a minimum of surface preparation.

The paint is recommended for use on gutters, downspouts, stacks, flashings, railings, machinery, metal window sash, building trim, utility poles, tanks, refuse containers, pilings, and metal fence posts. It dries to a semi-gloss finish and is intended for use as a finish coating and not as a primer.

It can be applied by brush, spray, or dip, and is available in 5-gal pails, 55-gal drums, and tank car lots.

More information? Circle Item 35 on postcard, page 142.

Outdoor Gas Heater

An infra-red radiant gas heater is being manufactured and distributed by Perfection Stove Co., Cleveland, Ohio, through a license from the American Infra-Red Radiant Co. under the Schwank German patents.

Developed in Germany, the Infra Rayhead heater has been used in Europe for the past 2 years. It operates on manufactured, natural, or LP gases and can be used indoors or out.

These heaters can lengthen the profit season for outdoor businesses such as outdoor dining rooms, drive-in restaurants, drive-in theatres, recreation areas, and food and news stands. Their use permits outdoor construction work to continue on a year-round basis. They protect concrete and masonry work from freezing without covering; cure tobacco, and dry crops, paint, plaster, brick, lumber, foods, paper and ceramics. And, they can be used to heat airplane hangars, warehouses, foundries, auditoriums, churches and stadiums. Morticians may also be interested in their use in cemeteries.

The company is planning to make the heaters in a variety of sizes, including one 12,000 Btu per hr unit which will heat sun porches, patios, lodges, and cabins, as well as broiling steaks and providing therapeutic heat.

The unit heats up instantly, directing a warm blanket of infra-red heat over an area of 80 to 100 sq ft. Because it only heats objects which cross its ray, it does not raise air temperatures (the photograph shows 2 heaters warming a model on the shore of Lake Erie when the outside temperature is 14 deg), and is practical to use outdoors and in well-ventilated indoor spaces.

The life of the heater is indefinite since only the surface of the ceramic catalysts reaches high temperature. Its heat may be directed upward, downward, or sideways.

The self-contained, portable unit holds a standard 100 lb or smaller LP gas cylinder, which is sufficient for 150 hours of operation. A detachable carrier makes the unit portable, however, it can also be permanently attached to walls, posts, or ceilings with the gas piped in to the unit.

More information? Circle Item 36 on postcard, page 142.

3 Types of Duct Connectors

Three types of flexible duct connectors are available from Grant Wilson, Inc., Chicago, Ill.

One, the Flexi-Duct, is a woven, flexible asbestos tape that comes in 50-ft rolls 6-in. wide with selvaged edges. It is for on-the-job fabrication and can be taped or bolted to equipment or ductwork.

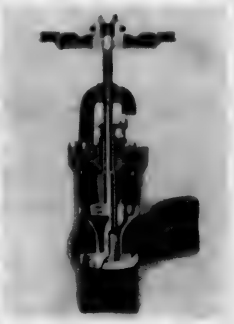
The other two connectors, called Vibra-Stop, come in two basic materials, asbestos (center) and canvas (right). A 4-in. strip of asbestos or canvas is factory-sealed to a 4-in. wide No. 1 prime galvanized metal on one side, a 3-in. on the other. Both fabric materials are Underwriters' Grade and meet Federal specifications.

Each type of the latter two connectors comes in 100-ft rolls that pull out as they are needed from 20x20-in. cartons. The metal-edged connectors can be installed by conventional methods.

More information? Circle Item 37 on postcard, page 142.

600-lb Valves Redesigned

Internal streamlining, which lessens wear and reduces pressure drop, is featured in the re-designed, 600-lb line of Rockwell-Built Edward globe and angle stop, check and non-return cast steel valves being built and sold by Edward Valves, Inc., a subsidiary of Rockwell Mfg. Co., East Chicago, Ind.



Features formerly available only in 900, 1500 and 2500-lb valves are incorporated into the 600-lb valves to improve their operation and cut down maintenance requirements. Included among features, are swivel disk construction, stellite faced disks, guided the full length of travel by integrally cast guide ribs, integral stellited seats, and the impacter handwheel.

The 600-lb valves, in sizes of 8 in. and larger, also feature an improved pressure-seal bonnet joint. This pressure-seal design, which is standard in the check and non-return valves of 900 psi and over, offers such advantages over the older line as the elimination of leakage, easier disassembly, bonnet joint tightness regardless of temperature, and low maintenance because there are no flanges or bolting to periodically restress.

The price of the new line will remain the same as the old 600-lb line.

More information? Circle Item 38 on postcard, page 142.

Condenser Reverses Air Stream

An ammonia condenser with a 200-ton refrigeration capacity is announced by Niagara Blower Co., New York, N. Y.

The basic principle of the condenser is that of evaporating sprayed water from the surface of condensing coils through which the refrigerant gas passes, extracting heat at the rate of 1000 Btu per lb of water evaporated. The air stream enters at the top of the condensing section, is drawn downward through the water sprays, over the condensing coils, and then turns upward to leave the unit through propeller-type fans at the top. This reverse direction air stream is a departure from previous practice and is a patented feature which increases the capacity of the unit and greatly reduces the outlay for electric power.

The spray water falls into a tank at the base of the unit, from which it is recirculated, with a net water consumption of less than 5% of the water used by submerged coil type condensers of equal capacity. The equipment is protected from freezing.

In addition, the unit is equipped with the company's Duo-Pass pre-cooling coil, which removes the superheat from the refrigerant gas, making it close to condensing temperature before it enters the sprayed, condensing section. This process avoids the precipitation of scale deposits. Also, in the gas line, between the pre-cooler and the condensing coil, a device called Oil-Out is located. At this point the oil vapor is condensed and removed from the refrigerant.

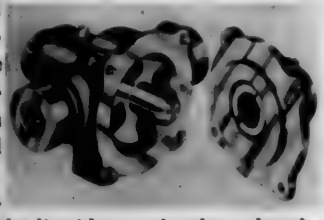
The unit measures approximately 8½ x 14 ft and 16 ft high. It weighs approximately thirteen tons.

More information? Circle Item 39 on postcard, page 142.

Variable Cavity Pump

Maintaining a constant volume of flow despite fluctuations in city water pressure is the function of a variable cavity pump made by Hypro Engineering, Inc., Minneapolis, Minn.

When the pressure in the pump reaches a predetermined point, a spring loaded end plate moves outward, increasing the length of the pump cavity and enlarging the clearances between the ends of the rotor and the end plate.



The increased clearances in the pump permit the liquid to recirculate, thereby reducing the pump's maximum pressure. Pressures can be varied in this manner from 3 or 4 lb up to 75 lb. When pressures drop, the end plate is automatically forced in by springs to reduce the clearances.

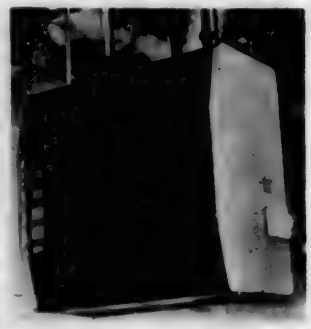
Pump parts are available with either ⅜-in. internal pipe thread or external garden hose thread. The hollow shaft pump can be slipped onto a ½-in. motor shaft. Rollers are made of nylon, stainless steel, or rubber, and the pump case is made of bronze.

The maximum expansion of the pump cavity at 75 lb is 0.005-in.; the maximum at 30 lb is 0.015-in. The end plate serves as a relief valve, without losing the pump's reversible rotation feature, and compensates for internal end wear. The end plate operates like a piston, with the internal section grooved anl fitted with an O-ring seal to prevent leakage.

More information? Circle Item 40 on postcard, page 142.

Larger Size Heater Offered

A 230,000 Btu per hr gas fired unit heater, announced by Henry Furnace Co., Medina, Ohio, increases the Moncrief line of unit heaters to 5 sizes, beginning with a 60,000 Btu per hr model for small stores and continuing through 90,000, 115,000, and 170,000 Btu per hr.



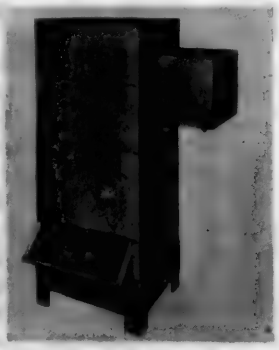
The unit heater is comprised of twin 115,000 Btu per hr heating units, with ribbon-type burners, encased in one cabinet that is enameled in two tones of grey. Its ignition is provided and flash-backs are prevented by stainless steel connecting strips. Deep pitch, propeller type fans circulate air over the sectional type heat exchangers, which are made of electrically welded steel. The pipe hangers are welded to the heat exchanger.

The units are factory-assembled and wired.

More information? Circle Item 41 on postcard, page 142.

Induced Draft Cooling Tower

A water cooling tower equipped with a centrifugal blower fan and called the AquaCooler is introduced by The Marley Co., Kansas City, Mo. The unit is an induced draft, counter-flow tower, currently available in 5 models rated from 3 to 15 tons.



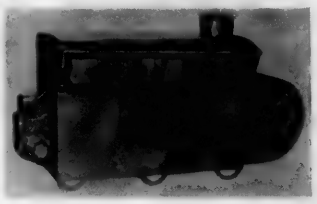
The towers utilize both a pressure spray system and redwood filling to produce the water break-up and cooling. The 3 and 5-ton models are made with a horizontal air discharge at the back of the tower. Other models discharge air vertically from the top of the tower. They can be installed either indoors or outdoors. Their basin and casing are constructed of heavy-gage steel that is galvanized and undercoated to resist corrosion. The motor, sheaves, and V-belt are also protected by a galvanized housing. All the parts of the tower can be reached either through the air inlet or a removable access panel.

More information? Circle Item 42 on postcard, page 142.

Semi-Portable Heater

A semi-portable space heater, the Waikiki No. 4820, which can be used to heat buildings under construction, garages, loading docks, sheds or to cure concrete, is announced by Vapor Heating Corp., Chicago, Ill. It heats and circulates 2500 cfm, and can be reduced to 900 cfm.

The heater has a home type oil burner or can be equipped with a natural gas or bottled gas burner. The fuel nozzles can be changed to give 80,000 to 200,000 Btu per hr input. A squirrel cage type blower circulates air around the three combustion chambers which have heat transferring surfaces to heat the circulated air.



Once started, thermostats with variable settings take over causing the heater and blower to automatically cycle on and off; an electric spark produces the ignition. The unit is installed by making three service connections: one to a 110-volt outlet, fuel to the burner, and an exhaust outlet.

The heater is enclosed in a metal cabinet that is mounted on legs so it can be picked up and moved about, or suspended from the ceiling.

The overall dimensions of the space heater are 48 in. long, 24 in. wide and 36 in. high with a shipping weight of 400 lb.

More information? Circle Item 43 on postcard, page 142.

Miniature Heat Exchanger

Miniaturization of electronic equipment components has progressed to the point where the various tubes no longer present the surface area to dissipate the heat which they generate while in operation. United Aircraft Products, Inc., Dayton, Ohio, has answered this problem for manufacturers of electronic equipment with circulatory cooling systems which can be installed remote from such equipment and still maintain it within its temperature operating band. These cooling packages employ the Hi-D heat exchangers recently developed by the company.

The cooling packages are designed for ambient temperature operations; cooled air duct or refrigeration installation; and the water boil-off system and hydrous ammonia evaporative system. The heat exchangers insure the low weight and high efficiency necessary for miniaturizing the size and weight of modern electronic components.

The heat exchanger package (right) is designed to permit its installation remote from the packaged controls (left). The heat exchanger portion of the assembly can be installed in a ram-air duct or the cooled-air duct loading from any refrigeration source. The unit uses OS-45 fluid.

This cooling package is an environmental system. It will operate from sea level to 70,000 ft and dissipate 350 watts when the temperature does not exceed 131 deg F at sea level or 0 deg at 70,000 ft.

The unit will consume approximately 60 watts of electrical power and no more than 15 watts of air horse power. It is constructed so that from sea level to 70,000 ft the hydraulic circuit is pressurized to a minimum of 2 psig at —65 deg and a maximum of 8 psig at 212 deg. A constant gage pressure is maintained regardless of altitude within these specified limits. The electronic equipment therefore is not over-pressurized at any altitude.

A centrifugal pump supplies the OS-45 cooling fluid. The pump has a shut off pressure of 17 psi and will deliver 1.75 lb per min against a 15 psi head. The maximum pressure on the case of the electronic equipment cannot exceed 25 psig. It weighs approximately 9 lb when dry.

More information? Circle Item 44 on postcard, page 142.

Fractional Horsepower Motors

Fractional horsepower motors engineered for industrial applications are announced by The Hoover Co., Electric Motor Div., No. Plainfield, N. J.

The motors, designated as Hoover Hy-Drive, have a number of design features which increase their industrial versatility. These features include a ribbed base, with widely spaced contact points to provide maximum rigidity and minimize pivoting effects; an 11-gage steel frame, registered on cast iron end shields, to prevent misalignment; Du Pont polyester film insulation in the stator slots; an improved ventilating design that permits air flow over the windings for cooling; and a centrifugal starting switch.

The motor conforms with NEMA standards for 56 frame motors.

Among the applications for which the motors are recommended by the manufacturer are pumps, machine tools, farm equipment, package air conditioners, industrial fans, and blowers.

They are available in 3 basic types: split-phase, capacitor-start, and polyphase, and in ratings ranging from ¼ to 1 hp. The available mechanical styles include drip-proof units, both sleeve and ball bearing, in rigid, resilient, or face mountings; totally enclosed ball bearing, rigid-mounted motors; and face-mounted ball bearing units, either drip-proof or totally enclosed, and which are suitable for vertical or horizontal installation.

More information? Circle Item 45 on postcard, page 142.

Has Commercial Capacity

A commercial water heater that has a delivery of 294 gph is manufactured by Pioneer Water Heater Corp., Los Angeles, Calif.

Its recovery rate is attained at a 60-deg rise by the 100-gal storage booster. Intended for large users of hot water such as industrial plants, hospitals, hotels and apartment buildings, the heater is also made in 85 and 50-gal sizes.

More information? Circle Item 46 on postcard, page 142.

Controls Recirculation

A cooling tower, the Wind-trol, in which a standard tower's component parts have been re-arranged to control recirculation, is announced by Santa Fe Tank and Tower Co., Inc., Los Angeles, Calif. The re-arrangement of parts permits the tower to be located without respect to wind direction.

The change in arrangement is intended to nullify the effect of recirculation caused by the tower structure upon itself. Uncontaminated intake air is allowed to pass freely beneath the structure and supply fans on both sides of the tower, with an excess of air discharging from the tower's leeward side. Recirculation is prevented because the exhaust vapors must move against this discharging wind stream.

Mounted on an open substructure, the tower and its redwood basin are supported by cast-in-place concrete piles. Drilling the holes for these piles is accomplished with a mechanical auger and without using forms.

The forced-draft fans are individually mounted on the ground on either steel pipe columns or small concrete structures and are not connected to the tower's structure. The fans are located outside of the packing area and discharge vertically into the external, vertical plenum area. They are placed so that sunlight, rain, or hot vapors will not come into contact with the blades or machinery.

The basin of the tower is constructed of dry, selected, clear heart redwood. After fabrication, it is coated with a water-proof membrane. Moist air sections not continuously wet are entirely removed in the counterflow tower.

More information? Circle Item 47 on postcard, page 142.

School Sink Has Fountain

An enameled cast iron sink, the Tech, designed for schoolroom use, is introduced by Kohler Co., Kohler, Wis. It is equipped with a gooseneck spout for filling receptacles and a bubbler for drinking.

Measuring 24 x 20 in. overall, the sink has a 3-in. ledge around the front and sides. The basin is 15 in. long, 14 in. wide and 8 in. deep, which affords ample room for ordinary schoolroom use.

A faucet, named Bardney, with a gooseneck spout, located on the left side of the sink, provides a source of water in the classroom for water color work, watering plants, filling fish bowls, washing hands, and cleaning paste jars.

The bubbler fitting, called the Station, mounted on the right side helps to reduce the number of out-of-the room trips by pupils. This fitting has a safety feature to prevent squirting of water by mischievous children. When a finger or other obstruction is placed over the fountain opening, the water stream is diverted to the drain. The fitting is mounted on a raised surface that extends 5/16 in. above the rim of the sink to meet code recommendations, which require a bubbler to be attached above the level at which water will overflow the rim.

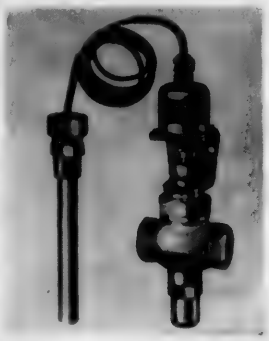
The sink is used by artist's studios and commercial laboratories.

More information? Circle Item 48 on postcard, page 142.

Temperature Actuated Valves

Two temperature-actuated valves have been developed by Electrimatic Co., Skokie, Ill.

The type WT is designed to control the flow of water, brine, oil, air, gas or other fluids used in cooling and other industrial processes. The valve opens with a rise in temperature and closes with a drop in temperature. It is available in direct-operated sizes of 3/8, 1/2, and 3/4 in. FPT and in pilot-operated sizes of 1, 1¼, 2, 2½, 3 and 4 in. Standard temperature ranges of the valve are 20 to 60 deg F, 60 to 100 deg, 100 to 140 deg, 140 to 180 deg, and 160 to 220 deg. The liquid pressure range is to 150 lb, and the steam range is limited to 15 lb.



The type HT is used to control the flow of hot water or low pressure steam used in heating or other industrial processes. The valve closes with a rise in temperature and opens with a fall in temperature. Its main application is in heat-exchangers and heating, but it can also be used as a by-pass control in cooling and process service within the temperature limits of the valve. Its temperature and fluid pressure ranges are the same as those for the WT valve. The connection sizes available for the direct-operated type are 3/8, 1/2, and 3/4 in. FPT and for the pilot-operated type 1, 1¼, 1½, and 2 in.

Both valves are manufactured in various type bulbs to permit the selection of the right bulb for the medium to be controlled. Their standard capillary length is 5 ft, but special lengths can be had to suit special applications.

More information? Circle Item 49 on postcard, page 142.

Insulation Fastener

A method of fastening insulation to metallic surfaces by using its 9SP Huckpin is introduced by Huck Mfg. Co., Detroit, Mich.

This fastening method was devised to speed and simplify the application of insulation to duct work. The No. 120 hand tool used to drive the pins, can be operated by one, non-skilled workman. The pins can be used on insulation up to 2-in. thick. The hand tool can handle the entire range of pin lengths by impaling the insulation on the protruding pins and pressing the sheet metal nuts over the locking rings.

More information? Circle Item 50 on postcard, page 142.

(Continued on page 135)

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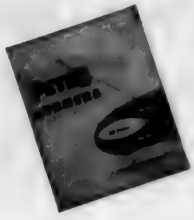

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G-E packaged air conditioning enables architect to "stretch" rentable space

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Putting air conditioning equipment in an existing building generally reduces net rentable floor space. However, when architect Robert Morris, of Wichita, Kan., finished converting the 7-story Rule Apartments to the Rule Office Building, he had actually *added* rentable space.

By putting 10-ton G-E Packaged Air Conditioners in small rooms formed by putting floors in old light courts, and a 7½-ton unit in the penthouse, he left the entire basement free for rental. Then, by equipping the packaged units with steam coils for winter heating, he gave each floor complete year-round control of its own "weather". By using the light courts, he was able to "stack" the units and save on piping.

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Packaged AIR CONDITIONERS

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(*Continued from page* 132)

Ceiling Air Diffuser

A ceiling air diffuser with a sleeve-type damper is a product of Connor Engineering Corp., Danbury, Conn.

A calibrated, sleeve-type damper regulates the air volume through the diffuser, which is called the Kno-Draft type ABC by the manufacturer. Inasmuch as the quantity of air and not the discharge velocity is affected by the damper, the diffusion pattern within the space remains uniform regardless of the damper's setting.

The photograph is a cut-away view of the diffuser, showing the internal construction and sleeve-type damper. The entire assembly of the inner cone and damper snaps in and out of the diffuser as a unit.

The diffuser is fabricated from spun steel and sprayed with an aluminum lacquer. It is available in 4 to 12-in. neck diameters.

A dimension table and selection curves of the diffuser are contained in Bulletin K-34.

More information? Circle Item 51 on postcard, page 142.

Device Detects Moisture

A moisture control system for refrigeration equipment has been developed by Ansul Chemical Co., Marinette, Wis.

Referred to as the Dry-Eye system, it performs the dual job of indicating when moisture is present in a refrigeration system and then removing it. It makes it possible for refrigeration maintenance men or owners to see and analyze the approximate moisture content of the refrigerant without shutting down the system.

The window of the unit contains a special indicating element which changes color depending on the moisture content of the refrigerant. When the window shows blue, the refrigerant equipment is dry. If it is pink, then moisture is present.

The device has implications for the industry because acid and sludge, two frequent causes of refrigeration system breakdown, invariably result from the presence of moisture. By spotting moisture trouble in its earliest stages it will be possible to avoid serious difficulties later.

To correct these conditions, the company makes the T-Flo Dry-Eye cartridge (upper photograph) which cleans the system by removing moisture or, if acid and sludge have already formed when the cartridge is installed, it will remove them too. When the cartridge has done its job, it can be removed without breaking the refrigerant line, and a new cartridge screwed onto the indicator fitting.

The system is expected to be important to refrigeration service contractors and engineers, as it will simplify and reduce the expense of servicing installations. The indicator fitting, which can be mounted in a readable position (lower photograph), will tell the service engineer when a drying job is complete. At the same time, owners of refrigeration equipment, who may be laymen, will be able to spot moisture trouble and call the service engineer before serious difficulties develop.

The cartridge is available in sizes of 8, 12, 20, and 30 cu in. The indicator fitting is available in ¼, ⅜, and ½-in. flare sizes. The cartridge and indicator are sold as one unit, in any combinations of the above sizes. All the cartridges are interchangeable on the fittings. List prices to the service trade for the system range from $7.60 for the 8 cu in. size to $10.85 for the 30 cu. in size.

More information? Circle Item 52 on postcard, page 142.

Crack Method Calculator

A direct reading calculator, which can be used to obtain the areas of floors, ceilings, and walls, is available from Paul S. Morton Engineering Service, Lawrence, Mich. Areas of windows that should be treated as glass, either by opening size or glass size, are also obtainable, along with the lineal feet of crack.

The device operates like a slide rule, and reads like a table. It is constructed of vinyl plastic in a pocket size, 3¾ by 9 in. On the back of the calculator, there are three scales along the edges. The price of the calculator includes a plain leatherette carrying case.

This model and the recently introduced Btu calculator are designed for computations by the crack method. A Btu calculator and an area and volume calculator are also available for computing heat losses by the air change method.

More information? Circle Item 53 on postcard, page 142.

Air-Cooled Condenser

An air-cooled condenser, the Atmos-Therm, for industrial plants, homes, stores, and offices is announced by Rempe Co., Chicago, Ill.

The coil of the unit is composed of copper tubes and aluminum fins in a casing of heavy-gage steel. All the headers and return bends are located in the air stream. The motors are enclosed to prevent them from projecting heat across the coil.

Four models are available which differ in their capacities, namely, 2, 3, 5, and 7½ ton. The 3-ton condenser is illustrated; it is 53-in. high, including the 15-in. stand, and 46-in. wide by 27-in. deep.

More information? Circle Item 54 on postcard, page 142.

Duct Insulation Cover

A plastic pipe insulation cover, Protektinsul, is being made for covering air-conditioning duct insulation by Miracle Adhesives Corp., New York, N. Y.

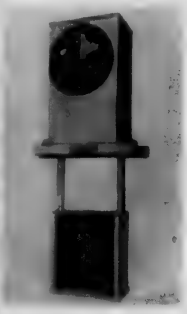
The cover, which is fireproof, is wrapped around a thermal insulated duct and closed by pulling a plastic device that locks the pre-formed edges of the cover together. The action of the plastic device is similar to that of a zipper.

End joints are then wrapped tightly with plastic tape, which is lapped over itself and the ends of the cover. Finally, a coating based on a vinyl resin is brushed on to seal the cover at the joints.

More information? Circle Item 55 on postcard, page 142.

Unit Air Cooler

An air conditioning unit which is hung from the ceiling like a space heater, but cleans and cools the air instead of heating it, is introduced by Simplaire, New York, N. Y. The air conditioner is called the Simplaire spot cooler by the manufacturer and has been assigned model number FAC-55-300.



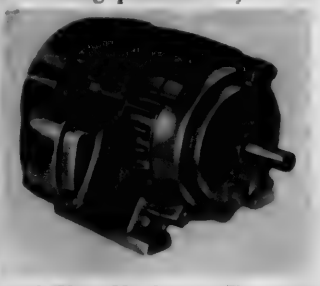
A typical installation is shown in the illustration. The air-cooled condensing unit is mounted on the roof and the evaporating unit depends from the ceiling of the floor below. The units require neither piping nor duct-work.

The air conditioners are made with a 2-ton refrigerating capacity and are intended to be directed toward spaces in a plant that are appreciably hotter than surrounding areas. However, multiple units can be spaced throughout a large, open working-area for overall cooling.

More information? Circle Item 56 on postcard, page 142.

Motor for Dangerous Locales

A NEMA-specification motor that is also made to meet specifications of the NBFU is being produced by U. S. Electrical Motors Inc., Los Angeles, Calif. It is designated as Type E and is made in ratings from 1 to 5 hp.



The motor is designed to operate in dangerous locales and is made for Class-I, Group-D services for highly inflammable gases and volatile liquids, and Class-II, Groups-F and G for combustible dusts. It is fully enclosed, with a provision to guard against fire, dust, and moisture and is equipped with a sparkproof aluminum fan. Another motor, Type EN, is made without the fan.

The conduit box is sealed with a split dome. The internal bearing caps are extended along the shaft to prevent sparks from traveling to the exterior. The rabbeted register fits are longer than in conventional motors in order to insure a complete seal of the bracket to the motor frame. The frame is made from one-piece of cast iron with external ribs for reinforcement and rapid heat dissipation.

A double-threaded drain plug can be furnished at the bottom of the end bracket.

Bulletin No. 1879 describes the motors.

More information? Circle Item 57 on postcard, page 142.

Portable Air Meter

The portable Anemotherm air meter, which gives instantaneous direct readings on air velocity, air temperature, and static pressure in heating, ventilating, and air conditioning systems, has been redesigned by Anemostat Corporation of America, New York, N. Y.

The air meter measures velocities from 10 to 8,000 fpm in increments as small as 5 fpm; temperatures to 225 deg F with an accuracy of about one-half of a degree, and static pressures directly in terms of inches of water from 0 to 8 negative and positive, with a sensitivity of better than .05 in. at the lower range.

The meter, which is contained in a convenient carrying case, can be used in ducts, free spaces, and at air inlets and outlets, and is suited for both field and laboratory work.

More information? Circle Item 58 on postcard, page 142.

Metallic Putty

An aluminum putty, which shrinks less than 0.2% while hardening, is available from Smooth-On Mfg. Co., Jersey City, N. J., for building up metal surfaces or for caulking seams and holes in metal and wood surfaces.

Though easy to mix with its curing agent, the putty, known as Metalset A201, will solidify sufficiently on standing for application with simple hand tools on vertical and overhead surfaces.

The putty hardens at room temperature and after it does harden, it can be machined by any conventional method, and can be tapped or drilled. When it is machined, its color approaches that of cast aluminum. It is not affected by water and resists acids and alkalis.

Its primary usefulness is for thick applications because there is no solvent used that will evaporate and cause shrinking or cracking.

More information? Circle item 59 on postcard, page 142.

(*Continued on page* 138)

The most practical way
to air-condition existing buildings!

Modine *AIRditioners*

Recommended for multi-room installation in office and apartment buildings . . . hotels and motels . . . hospitals and homes

— with types and sizes for every application

CONSOLE MODEL: Superbly styled and finished . . . blends with any interior. Developed for free-standing installation, yet can be recessed so only six inches of cabinet shows.

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OVERHEAD MODEL: Available with or without plenum and filters for use in furred overhead space.

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Cold water from a central chiller or other source is piped to each unit for summer cooling. Heating is accomplished with hot water from a central source. The same piping—water supply and return and drain—serves each unit for both cooling and heating. Yet AIRditioners are individually controllable!

For facts, call the Modine representative listed in your classified phone book, or mail the coupon today.

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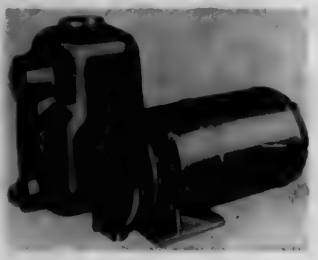
A-1255

(*Continued from page* 136)

Motor-Mounted Pump

A self-priming, motor-mounted pump designed for irrigation, general industrial use, air conditioning systems, and swimming pools is a new product of The Deming Co., Salem, Ohio, manufacturers of industrial and commercial pumps and water systems.



An automatic centrifugal pump, it is suitable for many moderate-size continuous circulating systems. A stainless steel shaft, a bronze semi-open impeller, and a rotary-type shaft seal are other features of the pump.

It is powered by a 3500 rpm, single-phase, or three-phase motor, and available in ½ through 5-hp motor capacities. Capacities to 110 gpm, and heads to 127 ft at 40 gpm are available.

Bulletin No. 3350 gives general specifications, approximate dimensions, and performance tables for the pump.

More information? Circle Item 60 on postcard, page 142.

Glass Insulating Block

A cellular glass insulating material which combines both insulation properties and a ceramic finish, has been developed by Pittsburgh Corning Corp., Pittsburgh, Pa. Called Duraface Foamglas, the material provides an impact-resisting surface with insulating and moisture-proof qualities.

With the material, an insulated and surface-finished wall (upper photograph) can be erected in one operation. No finish coating is required to protect the insulation. Unsupported walls can be built of the blocks because of their rigidity and compressive strength.

The material is inorganic and is not affected by fungus. It does not provide food or nesting material for rats and other vermin. Where sanitation and cleanliness are essential, such as in refrigerated food storage and processing rooms, walls made of the blocks can be washed down.

The standard size blocks are 18 by 12-in. They are manufactured in thicknesses of 3 and 4-in., depending upon the amount of insulation required. Double courses, using regular Foamglas for the inner course and the new material for the exposed one, can be specified.

The blocks are installed with either straight or staggered joints. Hot asphalt or a cold adhesive can be used for joining them. Where necessary, the blocks can be cut and trimmed on the job site.

The cellular structure of the material is a natural vapor barrier and absorbs no moisture that would reduce its insulating efficiency. In installations where high humidities or low temperatures exist, the joints between the blocks should be sealed. To facilitate this, the face edges of each block are beveled ¼-in.

The material is manufactured by the same process used for regular Foamglas. Pulverized glass and chemicals are placed in a covered stainless steel pan which travels through an oven in 1700-deg heat for about eighty minutes. The temperature is controlled so that gases given off by the chemicals collect in tiny bubbles of molten glass. The solidified block, as it leaves the cellulating furnace, is about six times larger than the volume of the pulverized glass and chemicals (lower photograph).

After the block leaves the cellulating oven, it is removed from the pan and transferred to an annealing furnace where it spends 12 to 14 hr cooling under controlled temperatures. The final step in production is facing and trimming the rough blocks into the standard sizes.

More information? Circle Item 61 on postcard, page 142.

Stack Cap Added to Line

A stack cap for use in industrial exhaust systems has been added to the line of industrial air-moving equipment manufactured by Hartzell Propeller Fan Co., Piqua, Ohio.

The stack cap is a band of 20-gage galvanized steel mounted on an angle iron ring, which bolts to a similar ring on the end of the vent. Two galvanized lids within the windband are mounted on a brass rod which turns in plastic bearings.

The lids open automatically when the system is operating and close when the fan goes off. When the lids are open, the air stream prevents the entry of rain or snow.

It is available in 11 sizes, from 12 to 48-in. diameters.

More information? Circle Item 62 on postcard, page 142.

Balanced Relief Valve

Pressure relief valves for applications where the pressure on the outlet side of the valve can vary, are manufactured by Associated Valve and Engineering Co., Chicago, Ill., and called the MIPCO Series. The valves have a stainless steel bellows which has the same effective area as the inlet port. This counterbalances the effect of the pressure on the discharge side of the valve.

They are available in forged carbon or stainless steel for pressures up to 1000 psig, 450 deg F, and in sizes ¾ to 2 in. IPS.

More information? Circle Item 63 on postcard, page 142.

(*Continued on page* 140)

There's a
Reznor
Gas Heater for
Every Engineered
Heating Job

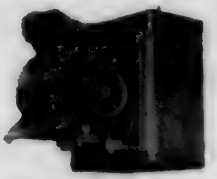
Gas Unit Heaters

self-contained, completely automatic units for production and distribution of heat at the point of need.

Wherever you go you'll find Reznor heaters proving their versatility in all types of commercial, institutional and industrial buildings from tiny shops to huge factories and warehouses.

There are two reasons why nearly 50% of the gas unit heaters sold today are made by Reznor — engineering leadership and fine construction. Both have been Reznor traditions since the first Reznor heaters were made, in 1888. An aggressive research and production development program has kept Reznor ahead of the field with improvements for greater comfort or more heat per fuel and equipment dollar. And Reznor's high standards of workmanship and materials mean greater efficiency and longer life.

Propeller Fan Type Suspended Units—nine sizes; 25,000 to 250,000 BTU.

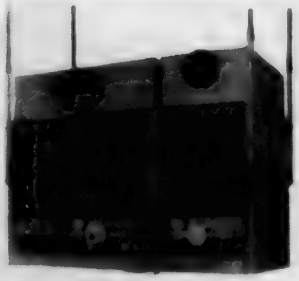


Blower Type Suspended Units—for use where quiet operation is a must — eight sizes; 25,000 to 200,000 BTU.

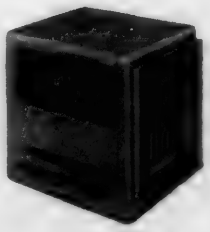
The New Reznor Twin Fan 250,000 BTU Model — another first for Reznor engineering.

Console-Styled Floor Models—for offices, stores and homes—three sizes; 25, 50 and 75 thousand BTU.

Two NEW Duct Furnaces



SERIES DS — Systems with capacities in excess of two million BTU can be assembled, on the job, out of the four basic DS sections. Section capacities are 150, 200, 250 and 300 thousand BTU. The largest single section weighs only 315 pounds. Each section complete with combustion controls and built-in draft diverter



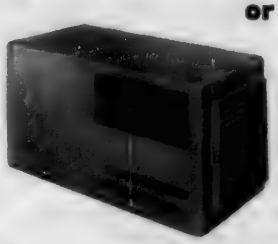
SERIES D — Four sizes; 50, 75, 100 and 125 thousand BTU — compact, handsomely-styled units are complete with combustion controls and built-in draft diverter

for use in custom engineered heating and air conditioning systems

These two new models, though varying greatly in details of design and construction, have the same advantages of high efficiency and easy installation as an integral part of the duct system. And both offer complete flexibility for combination with components for air-moving, cooling, cleaning and humidification chosen to meet the exact requirements of each job.

The Reznor PAC

compact horizontal furnace or deluxe unit heater



Compact design and appliance styling make the PAC ideal for crawl space and attic applications in residential heating or for suspended installations in basement, utility room or kitchen.

Used without ducts, the PAC becomes a deluxe unit heater which meets the most exacting requirements for cleanliness, quiet operation and fine styling.

REZNOR
THE WORLD'S LARGEST SELLING GAS UNIT **HEATERS**

Reznor Manufacturing Co.
64 Union Street, Mercer, Pa.

(*Continued from page* 138)

Twin-Unit Package Boilers

Utilizing 104 sq ft of floor area and 728 cu ft of plant space, a twin-unit package boiler installation, developed by Cyclotherm Div., United States Radiator Corp., Oswego, N. Y., delivers 10,000 lb of steam per hour.

Designated the C-5000, the units are each 8 ft long, 5 ft-1 in. wide and 7 ft high. In the twin unit installation a 2-ft-10-in. aisle is left between the boilers for servicing. Each unit delivers 5,000 lb of steam per hour, making a total of 10,000 lb.

Furnished with modulating equipment, the twin-unit can produce steam at ⅓ its rated capacity or 1,300 lb steam per hour. In this way, it can handle fluctuating loads from 1,300 lb per hour to the full 10,000 lb maximum with no lag in steam production throughout the cycling range, and no loss of efficiency. The units deliver a guaranteed efficiency of 80%. Operating pressures are available up to 200 psi.

Equipped with variable capacity burner nozzles, the units burn oil, gas, or a combination of the two.

In addition to the twin-unit, the company manufactures steam generators from 15 to 500 hp, operating at pressures up to 200 psi.

More information? Circle Item 64 on postcard, page 142.

Condenser Cleaner

A condenser cleaner, the Blo-Gun, is an addition to the line of condenser assembly and maintenance tools produced by Thomas C. Wilson, Inc., Long Island City, N. Y.

In the refrigeration field, the air or water operated cleaner is useful for removing soft deposits, such as mud, algae, and similar marine growths, from condensers. The gun makes use of the plug shooting or washing method. It weighs 2 lb and has an aluminum housing with a removable bronze nozzle and rubber spray shield.

A user can select either a corded-rubber plug or nylon spiral brush. Plug and brush projectiles are furnished with outside diameters in the range betweenn ½ and 1 in. The plug's irregular surface gives it a brush effect. The brush itself is made of stiff nylon terminating in a plug. Its ends are slightly less in diameter than the diameter of the tube, and water is free to flush ahead of the brush as it proceeds through the tube. Both plugs and brushes can be used repeatedly.

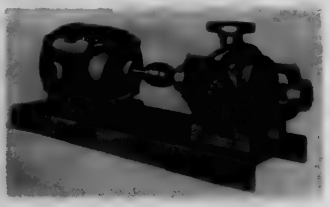
To clean with it, the plug or brush is first placed in the tube. The nozzle of the gun is then inserted and by a continued forward movement, compressed air or water is released, propelling the accessory forward through the tube.

More information? Circle Item 65 on postcard, page 142.

Feed Water Pumps

A new line of regenerative turbine pumps, designed for boiler feed service with boilers up to 1000 hp and operating at pressures up to 300 psi, is available from Roy E. Roth Co., Rock Island, Ill.

The pumps are 2-stage regenerative turbine pumps and contain a number of features. One is that they are equipped with low pressure stuffing boxes, which are obtained by the use of a throttle bushing under the stuffing box and a bleed-off arrangement back to the low pressure area in the pump. This arrangement enables the operator to pack for low pressures while the pump is operating. Balanced shaft loading is provided by opposing the discharge of the first stage to the discharge of the second stage.



There are ten models in the 2000 series and nine models in the 3000 series and all models are equipped with a stainless steel shaft. Their specifications are given in bulletin No. 107.

More information? Circle Item 66 on postcard, page 142.

Molded Pipe Insulation

Fibrocel is the name of a molded silica pipe insulation introduced by Johns-Manville, New York, N. Y. Engineered for service in the 35 to 350 deg F temperature range, the insulation is intended primarily for heating, plumbing, and air conditioning service.

It is made from a chemically inert silica aggregate containing, in its natural state, myriads of tiny trapped particles of water. Under the action of high temperatures in the manufacturing process, the water is vaporized, exploding the silica and causing it to expand to many times its original volume, like popcorn in a popper. The result is a light weight, inorganic, cellular structure containing voids or partial vacuums sealed by microscopic walls. This expanded silica is then die-formed to size.

For a period of years, the insulation was tested in the laboratory and in the field as insulation for hot, cold, and chilled water lines, low pressure steam pipes and dual service heating and cooling systems.

Information on its properties is available in an 8-page, illustrated brochure entitled Fibrocel.

More information? Circle Item 67 on postcard, page 142.

Humidifier Outside of Bonnet

A new equipment item on page 129 of the March issue described the Aprilaire humidifier, manufactured by Research Products Corp.. Madison, Wis., as adding moisture to air at the rate of up to 1 gpm; this should have read 1 gph, or gallons per hour.

PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on:

- **News of Equipment and Materials**

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- **New Catalogs**

Circle the item Numbers in which you are interested and print clearly your name and address with title.

NEW CATALOGS

DIFFUSERS AND GRILLES ARE SATELLITES—Three 4-page, 2-color catalogs of air distribution and air control diffusers and grilles are offered by Air-Factors, Inc., Monrovia, Calif. Catalog No. ECCO-198, gives information about ceiling air supply outlets designed for evaporative cooling systems, and outlets furnished with multi-louvers for balance or complete shut-off. Catalog No. FS-54 covers facts about the First-Grade line of forced air heating registers and grilles and includes data about cooling registers designed for use where evaporative cooling is used in conjunction with forced air heating. Catalog No. VC-198 is largely illustrative and includes information about the company's opposed blade damper series, the air volume control series and the multi-volume damper series. .....Item 181

FILTER MEDIA DESCRIBED IN BULLETIN—Performance data on porous Teflon filter media and information on filter units which use the material are contained in a bulletin issued by Porous Plastic Filter Co., Glen Cove, N. Y. Data is offered on the pore size of the material as well as the flow characteristics for air and water. Included also is information on the thermal and mechanical properties of this porous fluorocarbon. Criteria for the proper selection of filter forms are presented. .....Item 182

GLASS BLOCK REJECTS SOLAR HEAT—Functions of a new glass block designed especially for use in areas with severe sun conditions are described in a booklet made available from Kimble Glass Co., a subsidiary of Owens-Illinois Glass Co., Toledo, Ohio. Known as No. 66-F, the new glass block is designed for southern exposures to reject unwanted solar heat and light when the sun is at or near 45 degree altitude. Above and below the 45 degree band, acceptance of light gradually increases and the block is particularly efficient in transmitting cool ground-reflected light. A matching block for northern exposures, No. 99, is designed for the utilization of north light. .....Item 183

CUT-AWAY VIEWS OF STOKERS—A 12-page catalog, SB53, on its fluid ram and gear drive, single retort underfeed stokers is issued by Erie City Iron Works, Erie, Pa. Cut-away sections and detailed parts show the construction of stokers designed to handle loads of 100 to 300 developed horsepower. .....Item 184

BOILER DATA—A colorful 8-page brochure, No. WT-2, describing the 8-series of boilers has just been published and is available from Wm. Sires Boiler & Mfg. Co., Minneapolis, Minn. Complete data and specifications are given on each of the models and sizes in the line, with capacities ranging from 10,000 to 50,000 lb of steam per hr. A page is devoted to general design features and special 8-type construction features. .....Item 185

CARTRIDGE-TYPE FILTER—Literature about the Aerocelve filter is available from Cambridge Filter Corp., Syracuse, N. Y. The filter is described as being designed for air filtering in commercial and industrial ventilating air conditioning systems, and its characteristics are listed. .....Item 186

FOLDER OF FIRE PROTECTION EQUIPMENT—A catalog supplement of fire protection equipment is published by W. D. Allen Mfg. Co., Chicago, Ill. The supplement combines a file folder, to organize any loose material on the field, with data on several new products. .....Item 187

AUTOMATIC COAL STOKER CATALOG—Catalog No. 504 describes and illustrates the automatic coal stokers, called Unistokers, that are manufactured by Detroit Stoker Co., Detroit, Mich. In addition to the descriptions of the stokers, the catalog has photographs of the working parts of the stoker and cross-sectional views of the stoker that illustrate the manner in which it operates. Two pages of diagrams in the catalog show how the stoker should be installed in twelve different types of boilers. Photographs of the various installations, in which the stokers are being used, indicate the variety of methods of feeding the stokers. .....Item 188

INSULATED PIPING SYSTEM CATALOG—The completion of its 96-page catalog of insulated piping systems is announced by Ric-wil, Inc., Barberton, Ohio. The catalog lists illustrations and specifications of the company's insulated piping systems for underground or overhead use. Five separate sections make up the complete catalog. They are entitled Product, Engineering, Specifications, Drawings, and Installation. Each section has a tabbed, lead page of contents, and the engineering data and specifications have been brought up to date. .....Item 189

PUMP BULLETIN—A 12-page bulletin on Fig. 1300 two-stage centrifugal pumps, with horizontally split case and opposed impellers, has been prepared by Goulds Pumps, Inc., Seneca Falls, N. Y. The bulletin gives detailed information on specifications, materials of construction, and mechanical details of the pumps. It includes performance curves, and charts of interchangeable parts .....Item 116

UNIT HEATER CATALOG—A 2-color, 12-page, sales catalog on propeller fan unit heaters has been published by C. A. Dunham Co., Chicago, Ill., manufacturers of heating and cooling equipment. The bulletin, No. 1301-A, contains photos, drawings, and technical data on the construction, application, and installation of the redesigned unit heaters. .....Item 115

INTERVAL TIMER BOOKLET—Interval timers are the subject of an 8-page bulletin, PS-210, offered by the R. W. Cramer Co., Centerbrook, Conn. The 2-color booklet features exploded views, descriptive and technical data, wiring, dimension, and housing information, and a list of the company's representatives .....Item 113

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FIRST CLASS PERMIT NO. 61 SEC. 34.9 P. L. & R. NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING
93 WORTH STREET
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READERS' SERVICE DEPT.

SEA-WATER CONDENSER BULLETIN—A two-page bulletin, C-4, that gives detailed information concerning double-tube, counter-flow sea water condensers is published by Halsted & Mitchell, Pittsburgh, Pa. The bulletin describes the units as being made with cupro-nickel water tubes and naval brass headers, and that they are for marine use and other sea water conditions. Charts show water consumption versus inlet water temperature and water pressure drop versus water flow. Complete mechanical specifications are also provided. .....Item 113

MOTION PICTURE ON BASEBOARD HEATING—A motion picture was shown to a group of its sales representatives, meeting in Philadelphia at the time of the Heating and Air Conditioning Exposition, by Kritzer Radiant Coils, Inc., Chicago, Ill. It is a 16 mm black and white sound film with a running time of approximately twenty minutes, explaining the uses, installation and merits of radiant baseboard heating. The film is available through a company sales representative without charge. .....Item 114

BOILERS ARE ILLUSTRATED AND DESCRIBED—Bulletin No. C-1100-203 on its types AO and BA cast iron gas-fired boilers for hot water, steam heating, and hot water supply is issued by Worthington Corp., Harrison, N. J. The bulletin consists of a 3-page fold-out which illustrates the units in color. A cutaway of each unit enables the reader to see the various working parts, each of which is consecutively numbered and explained. Specification tables are included for each type boiler, listing the proper specifications of operation for radiation, hot water, and steam. A chart for each unit lists the various dimensions in inches for operation with manufactured, natural, mixed, and propane gases. Information is also included on the exact size of boilers for residential requirements. .....Item 115

CATALOG OF CONTROLS—A 32-page catalog describing automatic controls for heating, refrigeration, and air conditioning has been released by White-Rodgers Electric Co., St. Louis, Mo. The catalog contains information regarding room thermostats, space thermostats, relays, pressure and hydraulic-action temperature controls. Descriptions are also included of controls for oil and gas-fired systems of both warm air and hot water heating. Featured by the catalog are the company's new solenoid gas valves and improved automatic pilots. Controls for special specifications are also shown, such as explosion-proof thermostats ice-bank controls, and indoor-outdoor controls. .....Item 116

AIR CONDITIONING OUTLETS CATALOG—The release of an attractive 2-color catalog, No. 53, showing in detail every type of air conditioning outlet manufactured at its plant is announced by Barnes Mfg. Co., Cedar Grove, N. J., manufacturers of industrial and residential registers and grilles. In addition to the color photographs and detail sketches, prices and sizes are listed in a simplified manner. A feature of the catalog is a section devoted to charts of deflection. These charts can be used in every day operations to enable the user to solve problems relating to the purchase and installation of a particular register or grille for an air conditioning requirement. .....Item 117

LEAD-COVERED CATALOG—Its line of water heaters and heating boilers is compiled in a gold-embossed, leatherbound, loose-leaf catalog by Perfection Boiler Co., Brooklyn, N. Y. The catalog shows every size of water heater and heating boiler made by the company, giving specifications and trade prices for all sizes. The catalog was made loose-leaf so that literature can be added without difficulty. .....Item 118

EVAPORATIVE CONDENSER DESIGN EXPLAINED—The design of evaporative condensers is explained with a cut-away illustration and construction details in catalog No. 550 available from Aaron Industries, Inc., Jackson, Mich. Included in the catalog are performance curves for selecting units to use with either Freon or ammonia. .....Item 119

BLOWERS AND EXHAUSTERS ILLUSTRATED—A selection of blowers, exhausters, fans, and roof ventilators are illustrated by photographs in a brochure available from General Blower Co., Morton Grove, Ill. The front cover describes a pressure blower for corrosive gases. It also lists the blower's specifications and applications. The last page exhibits four photographs of installations of the company's industrial blowers. .....Item 120

BULLETIN DESCRIBES COIL-TYPE SPRAY DEHUMIDIFIERS—Detailed information on coil-type spray dehumidifiers is contained in an 8-page bulletin available from the manufacturer, Mario Coil Co., St. Louis, Mo. Included in the bulletin are complete data on the components and performance characteristics of the units, schematic drawings of standard arrangements, and instructions for ordering or specifying. .....Item 121

CEILING DIFFUSERS AND RETURNS ARE DESCRIBED—A 24-page manual, P 6307, containing information on Uni-Flo square and rectangular ceiling diffusers, Line-O-Flo ceiling diffusers, and square and rectangular ceiling returns, is available from Barber-Colman Co., Rockford, Ill. In addition to describing the diffusers, the catalog includes dimension drawings, ordering information, typical installation methods, and performance data that permits the engineer to determine the requirements of the installation while the box is in the layout stage. .....Item 122

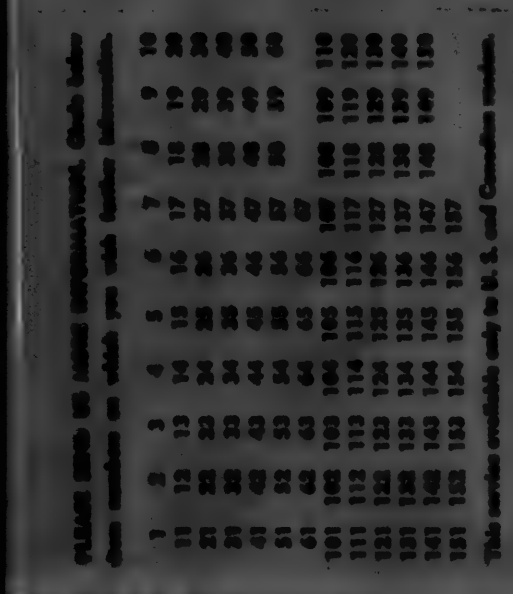
LUBRICATING FILM IS EXPLAINED—Bulletin 102, a 2-page, 2-color bulletin which describes Moly-Spray-Kote, a compounded dispersion of micro-fine molybdenum disulfide in a self-propelled aerosol-type sprayer, is available from The Alpha Corp., Stamford, Conn. The bulletin describes the functions of the lubricating film and its advantages in industry. Included in the bulletin are general specifications and recommended application procedures. .....Item 123

WATER SOFTENERS ARE DISCUSSED—Troubles caused by the utilization of hard water and the multiple economies effected by curing them are thoroughly discussed in a comprehensive 28-page bulletin, No. 1252-A, released by The Permutit Co., New York, N. Y. The bulletin lists several industries where steam and water are of importance and should be of interest to engineers dealing with water problems. Specifications, operating characteristics and typical installation photographs have been included. .....Item 124

TWELVE-PAGE BOOKLET PUBLISHED—A 12-page booklet, entitled This Is us-AIRco, describing the company's history, products and manufacturing facilities, is announced by the United States Air Conditioning Corp., Minneapolis, Minn. The two-color pamphlet, liberally illustrated, traces the company's expansion, progress and contributions to the industry since its founding in 1928 under the original name Arctic Nu-Aire. Also included are details of the company's heating, ventilating, and air conditioning products. .....Item 125

POPPET-TYPE RELIEF VALVES—A four-page folder entitled, Poppet-type Relief Valves, catalog V-N54-A44, is issued by Watts Regulator Co., Lawrence, Mass. It compares the fuse type and fully automatic type relief valves and introduces the company's extension type thermo-tube which is replaceable without removing the valve from the line or destroying pressure setting of valve. .....Item 126

ALLOY TUBING BULLETIN—Information of interest and value to engineers and designers associated with the use of tubing for elevated temperature and pressure service is included in a data folder published by Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa. The folder shows the chemical analyses of the standard carbon, alloy, and stainless tubing steels used in such service. It is cross-indexed to associate grade and ASTM specifications for the individual tubing steels involved. For ready reference, the bulletin also lists the ASTM tubing and pipe specifications by number and title. Copies of the folder, TDC 177, are available upon request. .....Item 127



CONDENSED BOILER CATALOG—A revised edition of its 32-page general catalog, Number 9, published as a condensed but complete product guide for the engineer, heating contractor, and architect is announced by Kewanee-Ross Corp., Kewanee, Ill. Index, illustrations and tables are so arranged as to provide smooth, easy to read reference data from cover to cover. It contains the latest and most complete information on the entire line of the company's high and low pressure steel boilers for commercial, industrial and residential use. Also included are full descriptions and illustrations of water heating products, both direct-fired and storage types as well as indirect water heating coils. Pages on boiler supports brackets, structural steel suspension and induced draft fans as well as pictures of typical boiler installations complete the technical manual. .....Item 131

VALVE COMPARISON CHART—A reference manual, The Fairbanks Valve Comparison Chart, for specifying, ordering, and using bronze and iron-body valves, is available from The Fairbanks Co., New York, N. Y., manufacturers of valves, trucks, casters, and wheels. The manual is organized by manufacturers and numerical sequence, and has charts that detail the company's bronze and iron-body valves compared with the valves of other leading manufacturers. .....Item 132

COPPER DRAINAGE PIPING — Funny wise, the Story of Anaconda Type M Copper Tubing, a 16 mm, Kodachrome, sound motion picture, is released by The American Brass Co., Waterbury, Conn. Lowell Thomas narrates this new 17-minute film. It demonstrates advantages of non-rusting, lightweight, easily assembled copper tubes for sanitary drainage systems in domestic and commercial plumbing. Installation sequences of various soil, waste, and vent lines are shown. Prints are available without charge for showing before professional, service, trade associations, or other interested groups. .....Item 130

BULLETIN DESCRIBES CONDENSATION RETURN PUMPS—Bulletin 112-LR-A, available from Aurora Pump Div., The New York Air Brake Co., Aurora, Ill., describes Type-Matic condensation return units, for heating systems with ratings from 300 to 10,000 EDR and pressures up to 30 psi. The 4-page, 2-color bulletin describes the construction of both the Simplex, single pump, and Duplex, twin pump, models. The bulletin's selection tables for both types include dimensions, capacities, weights, and condensed specifications of the complete range of sizes available. The bulletin is illustrated with photographs of both models, and with section drawings accompanied by parts lists. There are also illustrations of the company's other pumps. .....Item 131

HOW LUMINOUS CEILINGS CAN BE USED—A 15-page brochure describing the effects of luminous ceilings on light, sound, and air flow is offered by Luminous Ceilings, Inc., Chicago, Ill. Section 3 of the publication illustrates, diagrammatically, the air distribution chamber obtained by using the ceiling in air conditioned rooms. .....Item 132

HEATING AND HANDLING RESIDUAL FUEL OILS—A concise presentation on how to heat and handle heavy fuel oils for use in the burners of boilers, furnaces, and processing equipment of industrial and commercial plants and buildings is given in Bulletin 1201 issued by Frederick Utilities Mfg. Corp., New York, N. Y. There is also a description on the company's Kilnoil heat method of maintaining the oil in the line from the tank in pumpable condition. .....Item 133

BULLETIN LISTS MANAGEMENT BENEFITS—Bulletin 146, showing how mounting machinery increases production output and lower production costs, is available from Barry Controls Inc., Watertown, Mass., manufacturers of shock and vibration isolation equipment. The bulletin also gives a summary of the types of Barrymounts which have been engineered for various machines. .....Item 134

STEAM AND HOW TO USE IT—A capsule refresher course in the use and specification of steam for heating is published by the Steam Heating Equipment Manufacturers Association, Chicago, Ill. The 16-page booklet, entitled What You Should Know About Modern Steam Heating, starts with a section on basic steam physics and describes the characteristics of steam, relating them to specific efficiencies and advantages in individual applications. It outlines the types of buildings, equipment, and heating requirements served most economically and efficiently by steam. Problems of heating control maintenance, repair and alteration are also discussed in detail, with relation to commonly-used heating mediums. .....Item 135

COMBINATION MANUAL AND CATALOG—A 12-page, 2-color, combination engineering manual and catalog describes the pipe connections, unions, and bleeder valves manufactured by Gray Tool Co., Houston, Tex. Describing a concept of all-steel sealing with a pressure-aided seat, the book shows how this principle has been incorporated into a pipe connection and union, covering connection ranges from ⅛ to 12 in., and a vent-drain-bleeder. In addition the book gives data on construction, specifications, dimensions, and pressure ratings. .....Item 136

CALCULATES INDUSTRIAL HEATING REQUIREMENTS—A slide calculator for estimating electric heating requirements is available from Edwin L. Wiegand Co., Pittsburgh, Pa. The pocket-sized slide chart is used for estimating either industrial tank heating needs or comfort heating requirements of rooms in offices or factories. Kilowatt capacities can be obtained by using the dimensions and specifications of a job. .....Item 137

BULLETIN ABOUT FINNED TUBES—A bulletin, No. 155, is available from Kritzer Radiant Coils, Inc., Chicago, Ill., explaining the installation and operation of finned tubing for radiant panel heating installations. It discloses in general terms the installation, operation and advantages of radiant panel heating. .....Item 138

GUIDE FOR WHOLESALERS—An 8-page, 8½ x 11-in., buying and selling guide is issued by Grant Wilson, Inc., Chicago, Ill., to wholesalers in the heating, plumbing, air conditioning, and ventilating trades. The guide is designed to tell the wholesaler what the company's products look like; what they are for and where they are used; their specifications; and what each of the products will cost him, in addition to recommended resale prices. The front page has an index by product name and description; the back page has tables; and the remainder of the guide shows pictures of the products, brief stories of where and why they are used, shipping weights, list prices, costs, and resale suggestions. .....Item 139

INFORMATION ABOUT VENTILATING AND EXHAUST SYSTEMS—An 8-page brochure, written to aid companies in selecting and installing corrosion-proof, polyethylene ventilating and exhaust systems, is available from American Agile Corp., Bedford, Ohio. The purpose of the literature is to enable firms to adapt the do-it-yourself trend in installing such systems by using prefabricated components and fittings. One section illustrates and describes various possible complete installations, and explains how potential users can determine the quantity of materials needed and their cost. Overall, the brochure covers such components as polyethylene seamless ducting, duct fittings, exhaust hoods, centrifugal fans, and weather caps. Actual photographs of other polyethylene ventilating and exhaust systems and components are also included. .....Item 140

VITRIFIED TILE CONDUIT DISCUSSED—Vitrified tile conduit for underground insulated piping is discussed in catalog 54 available from Steam Conduit Div., Universal Sewer Pipe Corp., Cleveland, Ohio. The 12-page catalog gives the specifications of various strengths and types of tile conduit in addition to describing the applications of the conduit. There is a brief discussion in the catalog on the various construction features of the conduit, and engineering data and drawings are included. .....Item 141

BULLETIN DESCRIBES RESTAURANT WATER MIXING VALVE—Details of the specifications and installation of a mixing valve designed for use with the A. O. Smith-Burkay glass-lined restaurant water heater are given in a bulletin, GH-95, prepared by Permaglas Div., A. O. Smith Corp., Kankakee, Ill. The bulletin describes the mixing valve's employment in providing 180-deg sanitizing rinse water plus general-purpose water at the temperature desired in small and medium restaurants. .....Item 142

SEWAGE EJECTOR TABLES—Engineering tables that simplify the selection of clog-proof Flush Kleen sewage ejectors are offered by Chicago Pump Co., Chicago, Ill. Examples are given for determining the inflow, discharge heads, and type of sewage ejector to use in underground municipal lift stations, industrial applications, and building installations, such as hotels, apartment buildings, and railroad stations. .....Item 143

DESIGNED PUMP IS DESCRIBED—Unit pumps designed specifically for air conditioning and refrigeration installations are described in a catalog available free from Lancaster Pump and Mfg. Co., Inc., Lancaster, Pa. The catalog has non-overloading performance curves and lists the specifications of the pumps. It discusses the recent improvements in the design of the type M unit pumps manufactured by the company. .....Item 144

UTILITY FAN BULLETIN ANNOUNCED—A bulletin, No. DS-345U, describing the recently announced re-designed and expanded line of utility fans is available from The Trane Co., La Crosse, Wis. The 24-page bulletin describes in detail the advantages of the new belt-driven and direct-drive centrifugal fans, their construction features, and special features for specific types of applications. More than half of the booklet is devoted to fan selection data, and in this section there are capacity tables for all sizes and types, roughing-in dimensions and mechanical specifications. .....Item 145

COMPLETE SET OF WELDING ELECTRODE LITERATURE—Available from Metal & Thermit Corp., New York, N. Y., is a complete set of literature designed to be of help to welding engineers and others concerned with production and maintenance welding. This series of catalogs describes the entire line of Murex electrodes for arc welding as well as rods and wire for gas, submerged arc and inert arc. Specific catalogs cover electrodes for mild steel and low alloy, mild wire for submerged arc welding, stainless steel electrodes and bare wire, aluminum and phosphor bronze electrodes and bare wire, aluminum electrodes and bare wire, electrodes for cast iron, gas welding rods and tungsten rods. Full information including physical properties, chemical analyses, qualifications, procedures, sizes and general engineering data is contained in each catalog. .....Item 146

REPRINTS OF WELDING ARTICLES AVAILABLE—Practical Design for Welding is the title of a reprint of a series of three articles presenting principles for the practical designer to use in designing welded steel machine parts and machinery available from The Lincoln Electric Co., Cleveland, Ohio. The practical information covers factors that determine costs, how a weld may be calculated to meet stipulated load requirements, how to eliminate guesswork from design computations, how to use steel to best advantage in comparison with cast iron and how to control distortion. A typical problem is worked out. .....Item 147

GUIDEBOOK TO AIR DIFFUSERS—A 64-page selection manual, containing over 200 illustrations showing installation, design and use of aspirating air diffusers and accessories, is issued by Anemostat Corporation of America, New York, N. Y. The manual has a special section on high velocity units, which is of interest to architects, consulting engineers, contractors, and others in the air conditioning field. It also presents detailed information on the selection of air diffusers for various installations, including considerations of the sound levels of the air diffusers. Along with drawings, photographs and cutaway views of diffusers, the manual offers tables and charts showing data on design and performance characteristics of the company's products. Descriptions of each piece of equipment are accompanied by specification tables of the different sizes available, and photographs of smoke tests demonstrate their air distribution patterns. .....Item 148

WROUGHT IRON PIPE DATALOG—A 16-page manual entitled Wrought Iron Pipe Catalog and containing technical information frequently required by architects, engineers, piping contractors, builders, maintenance superintendents, and other specifiers of pipe and tubing, has been published by A. M. Byers Co., Pittsburgh, Pa. More than 15 separate tables list size and dimensional data of wrought iron pipe and tubular products. Other tables record dimensions of pipe in fractions of an inch, decimals of a foot equivalent to inches and fractions of an inch, any decimal equivalents of fractions of an inch. Data are also provided about wire and sheet metal gages, flow of water in gallons per minute and conversion factors. The individual tables include size and dimensional data for standard weight pipe; extra strong and double extra strong pipe; standard weight threaded line pipe; buttwelded standard weight, plain-end line pipe; lapwelded regular weight, plain-end line pipe; butt and lapwelded, extra strong, plain-end line pipe; and large outer diameter pipe. Other tables provide data about oil well tubing and casing, inserted joint casing, and standard drive pipe, water well reamed and drilled pipe, water well casing, signal pipe, refrigeration or ammonia pipe, cable conduit, cold drawn heat exchanger and condenser tubing, and wrought iron standard weight and extra strong nipples. Supplementing the tables is information about wrought iron's physical characteristics and special properties, specifications of technical societies, mill standards, identifying markings, and ordering procedure. The catalog can be obtained by writing on company letterhead. .....Item 149

BULLETIN DISCUSSES UNIT HEATERS—A 12-page bulletin, No. 454, on the construction, application, selection, and performance of its gas-fired unit heaters is offered by Modine Mfg. Co., Racine, Wis. Printed in color, the publication makes extensive use of cutaway and outline drawings that illustrate the features of the heat exchanger, the burner, and other component parts of the heaters. Dimension, weights, capacities, and suggestions for locating the unit heaters are covered in detail by drawings and charts. Other features covered by the bulletin are the reason the light weight permits fast and economical installation; why the heat exchanger design promotes fast, uniform heating and quiet operation; and uses for the unit heaters in other than strictly heating applications. The comparative life expectancy of the stainless steel heat exchanger and burner, as compared to other metals frequently used for these vital parts, is shown in one of the charts. The availability of heat exchangers in stainless steel or aluminized steel is pointed out in the bulletin. Photographs of installations where the heaters are now in use, names and addresses of the company's representatives in the United States and Canada, and other products are also included. .....Item 150

CATALOG OF MECHANICAL AIR FILTERS—Fixed panel and traveling curtain air filters, designed and manufactured by Trion Inc., McKees Rocks, Pa., are the subject of a 16-page catalog, M-10, published by the company. The catalog includes the history, the principle of operation, applications, filter test methods, engineering data, descriptions, and suggested specifications of the filters. It was prepared as an aid to architects and engineers who have the responsibility of selecting filters. .....Item 151

ELECTRIC VALVE CATALOG—A general catalog of its solenoid-operated valves is published by Skinner Electric Valve Div., Skinner Chuck Co., New Britain, Conn. The catalog describes five basic electric valves and discusses their possible variations. It also explains how to choose the correct valve for various applications. The catalog is written in non-technical language and is illustrated by pantographs and charts. It is accompanied by a price list which is cross-indexed for quick reference. .....Item 152

FILM TELLS STORY OF FRAMING—A 16 mm color and sound motion picture entitled, The Sky's The Limit, is being released by Unistrut Products Co., Chicago, Ill. In preparation for a full year, the film tells the basic story of Unistrut metal framing in color, cartoon animation, music and special effects. Mr. Strut, an animated character representing the framing, helps to demonstrate in detail the channels, parts, and fittings of the framing system, and to show their function. Engineers, architects, contractors, jobbers, and salesmen will be interested in the film because of its practical approach to the application and use of metal framing in the electrical, mechanical and materials-handling fields. In addition, the film views new and different applications of metal framing in other fields, and treats the audience to a look into the future where the framing is applied to the construction of an entire city. In 23 minutes, the film shows the technical features and advantages of the framing system. The film is being shown at the company's distributors' show rooms in principal cities. .....Item 153

INDICATING TEMPERATURE CONTROL—A 6-page brochure, Bulletin 42, issued by United Electric Controls Co., Watertown, Mass., describes and illustrates a recently developed instrument designed to control and indicate the temperatures of gases, liquids, or hot plates over wide ranges. The brochure gives typical applications and the engineering data required by designers. .....Item 154

BULLETINS DISCUSS CONTROLS, RELAYS, AND VALVES—Three bulletins and a specification sheet are published by Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Bulletin 1120 describes pneumatic controllers, their applications, and how they work. It also describes pneumatic transmission systems and cascade ratio and other interconnected control systems. Besides this information for the industrial designer, the bulletin also contains practical information for plant operators on how to tune pneumatic controllers to a process, how to introduce manual adjustments, and how to provide the best air supply. Bulletin 1110 describes an automatic ratio relay which receives pneumatic input signals from two sources and transmits an output signal that is proportional to one of the inputs, with the degree of proportionality determined by the second input signal. Bulletin 1501 gives information required for the selection of the company's valve bodies, linkages, and power units, along with references to other sources of data on the subject. Specification sheet 902 describes internal cam programmer thermometers that are designed to maintain a definite relationship between temperature and time. .....Item 155

150-LB STAINLESS STEEL PIPE FITTINGS BULLETIN—The 150-lb stainless steel pipe fittings recently announced by Watson-Stillman Fittings Div., H. K. Porter Company, Inc., Roselle, N. J., are described in Bulletin 3-2-45. The bulletin presents the dimensional specifications of the stainless fittings in sizes ¼ to 2 in. in both screw-end and socket-welding types. .....Item 156

HYDRANT MANUAL—To help engineers, builders, plumbing contractors and other specifiers select the correct hydrant for various installations, Plumbing Div., J. A. Zurn Mfg. Co., Erie, Pa., is publishing an illustrated, 16-page catalog, Manual 14-A, of non-freezing ground and wall-type hydrants. Pictured and described in the catalog are models of each of four types of hydrants including wall installations, post and box type and recessed hydrants. The manual contains hose and pipe sizes, engineering drawings, roughing-in dimensional data, uses and recommended specifications. Listed separately are simplified maintenance parts for each type of hydrant installation. Also included in the manual is a brief discussion of maintenance procedure and recommended stock of replacement parts. .....Item 157

An engineer from Quinn & Feiner, Refrigeration and Air Conditioning contractors, shown checking the largest reciprocating compressor installation in the East.

McCrory's

IS A PLEASANT PLACE TO SHOP

p·k COOLERS ARE INSTALLED HERE

McCrory's spacious and sparkling new store at Livingston Street in Brooklyn is the world's largest variety store. Careful planning has made it an inviting place to shop. p·k dry expansion freon coolers, an integral part of the air conditioning system, supply chilled water to eight remote conditioners. Four of these coolers – three in the sub-basement and one on the second floor – provide a total capacity of 350 tons of refrigeration in which they cool 1000 GPM of water to 44 deg. F.

Economical and efficient, p·k coolers have earned a place for themselves in commercial and industrial building. A pioneer in the development of many types of heat exchange equipment, p·k has provided exchangers for virtually every type of application.

What are your heat exchange needs? Heating? Cooling? Custom built or standard units? p·k has a wealth of experience in helping people like yourself select the proper equipment for their particular applications. p·k catalog #101-A gives standard range of freon coolers.

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PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

Fans Ventilate New TV Studios

PROBLEM: A sign saying "Silence" or "Quiet" in a television studio means emphatically just that. It applies especially to ventilating fans and motors. In the new studios of the Dumont Television Station (see cover photo) in Pittsburgh, Pa., vast quantities of heat generated by intense lighting and other electronic equipment had to be removed quickly in order to maintain comfortable conditions for entertainers, visitors and Dumont employes. At the same time, there could be no annoying and distracting sounds from the ventilating equipment.

SOLUTION: To do the job at Dumont requires the circulation of over 75,000 cubic feet of air every minute. This volume of air is moved and conditioned by 13 Westinghouse Sturtevant air handling units, a surface dehumidifier and 3 giant fans. These units draw in fresh air from outside the building, then cool, heat or humidify the air as required.

RESULTS: Although performing a most important function in the operation of the studios, these air handling units are seldom noticed. Selected first for extreme quietness of operation, the units were installed on rubber supports to alleviate vibration interference. In addition, the units were mounted just below the ceiling in property room areas where they occupy no valuable floor space and yet they are always accessible. Generally speaking, each room in the studio has its own air handling unit so that each area can be regulated independently.

Electric Unit Heaters Warm Plant

PROBLEM: The S. E. Massengill Company of Bristol, Tenn., manufacturers of pharmaceuticals, faced a heating problem when constructing a new manufacturing and shipping building. The steam plant for existing structures was already operating at capacity.

SOLUTION: The company installed 100 electric unit heaters each having 15 kw capacity. Heaters were so placed that the heater fans circulated air continuously around the inside walls of the building.

RESULTS: Low maintenance and low power rates make this system economical. Circulating air maintains an even 72 deg throughout the entire building, cubic content of which is 1,418,640 cubic feet. This is the largest commercial building electrically heated in the United States.

Maintenance Made Easy with Polyester Resin

PROBLEM: A recent example of the versatility of Celanese polyester resin in the maintenance of plant equipment was the repair of a water header at the Bishop, Texas, plant of Celanese Corporation of America. Approximately 40 lineal feet of the header pipe had eroded, with large holes in some areas and the balance of the pipe rusted almost paper thin. There were about 20 holes below the water level of the pipe, which normally runs half full.

SOLUTION: The repair procedure used was as simple as it was effective. First, scale was knocked off and two plies of glass cloth, saturated with a self-curing blend of Celanese MR-28C Resin, were applied over the large holes. Leaks were then plugged and two additional plies of glass cloth, thoroughly saturated with the resin, were wrapped about the entire rusted area of the pipe, one at a time.

RESULTS: Just 30 gallons of resin were required and total material costs amounted to only $137.88. It was, of course, unnecessary to remove the multiple connections or the pipe itself. Thus, many costly man-hours, that would normally be required if the section were replaced, were avoided. The reinforced Celanese polyester laminate has ample strength to carry the weight of a man standing over the completely rusted-through section of the header. The laminate will not rust or rot and its moisture absorption is less than half of 1%. Experience indicates that long, trouble-free service can be corrected. But in the event that accidental rupture occurs, it is only necessary to apply additional laminate to the damaged area.

Cooling Equipment Placed in Church Steeple

PROBLEM: The First Methodist Church located in the downtown section of Morehead City, N. C., a southeastern coastal resort was beset with several major problems.

(1) Construction of a new education building had cut off ventilation in the sanctuary. As a result, temperatures were intolerable during Sunday morning services.

(2) Long motorcades from the nearby military training camp frequently passing through the city and in front of the church on Sunday mornings and the inevitable din of street noises, added to the difficulty.

(*Continued on page* 148)

PEERLESS Hi-F (High Efficiency) AIR COOLED CONDENSER

NO-WATER

Hi-F Air Cooled Condenser for mounting in stand on roof or remote outside location—also indoor installations with discharge duct to outside. Low Cost. ELIMINATES USE OF WATER. ¾, 1, 1½, 2, 3, 5, 7½ and 10 ton capacities.

Peerless is a name that dates back to the pioneer days of finned coil manufacture. With this background of experience it is no wonder that to "oldsters" in the industry and "newcomers" as well, the name Peerless stands for integrity.

The Hi-F Air Cooled Condenser is the culmination of years of know-how reflected in a design that assures maximum B.T.U. capacity season after season. In addition, the new and exclusive patent-applied-for Peerless manufacturing process is so efficient and rapid in operation that on time delivery is assured to any contractor even under emergency conditions.

Write for Bulletin No. NW 155 containing full engineering information on the Hi-F Air Cooled Condenser.

MANUFACTURERS, NOTE—*Send us blue prints of your evaporator and condenser requirements for a Hi-F quotation. Please indicate delivery requirements.*

PEERLESS OF AMERICA, INC.

Dept. A, 6930 N. PULASKI ROAD, CHICAGO 30, ILL., U.S.A.

(*Continued from page 145*)

(3) There was also a problem of excessive humidity.

(4) Attendance was always highest in the summer when vacationists and weekenders came to the shore, but the discomforts resulting from the little church's downtown location discouraged larger congregations.

To build another church outside the city was a possibility, but that would have required a large expenditure of money. The present edifice had only recently been built and the members did not feel that their church should be abandoned, torn down or sold. The answer was found in air conditioning, but the modern little church, heated by a radiant system from pipes embedded in the concrete floor, had no ductwork and no available space to install packaged conditioning units.

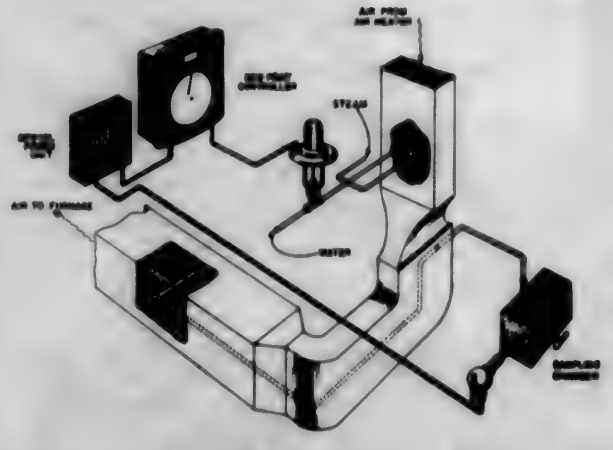
SOLUTION: Stahl-Rider Kinston, Inc., dealer for Carrier in Kinston, N. C., solved the dilemma by installing a Carrier reciprocating compressor providing a capacity of 25 tons of cooling in the unused area inside the steeple. An overhead duct system for distributing cool, dehumidified and filter-clean air served by a Carrier central system Weathermaker, was also located in the steeple. On the roof of the adjacent Sunday School a Carrier evaporative condenser was placed, saving approximately 95% of the water used in refrigeration condensing.

RESULTS: The little church in Morehead is probably the first to have air conditioning along with bells in its steeple.

Dewpoint Control Cuts Tube Deposits

PROBLEM: At one of the plants of the Detroit Edison Co., fireside deposits on boiler tubes and stoker-fired furnaces created the problem of frequent shutdowns for cleaning and repair.

SOLUTION: The humidification system for controlling the dew point of combustion was put in operation under control by a Foxboro Dynalog Stabilog Controller. The moisture content of air from the preheaters is measured by a Dewcel element in a continuous sample. The controller records the dewpoint on a circular chart and automatically operates a valve to control flow of water which is injected into the air ducts in the form of a fine mist.



RESULTS: Moisture content of combustion is maintained at 79 degrees dewpoint, proved by tests to produce an optimum low rate of fireside deposit formation. The system is credited with substantially reducing shutdown time and maintenance costs.

Industrial Heater Warms School Addition

PROBLEM: As with many other expanding schools, the Twinsburg School Board of Summit County, Ohio, and its architectural firm, Fulton, Krinsky & Della Motte, Cleveland, Ohio, were obliged to stay within a specific budget. At the same time, they were faced with the job of providing adequate warmth and fresh air in the classrooms. They also had to recognize the fact that any additional custodian duties brought about by the added space and heating facilities would require the hiring or additional personnel.

SOLUTION: After making a comprehensive study of various heating systems, the architects decided on a separate recirculating warm air system incorporating a Dravo Counterflo oil fired space heater as being the most economical solution. Its first cost would be modest, there would be no need to enlarge the custodian staff in that its operation was automatic, and fuel cost would not be out of line.

To enlarge the present heating system was economically unsound. It consists of 5 inefficient, 31-year-old, coal fired warm air furnaces using 100% fresh make-up air continuously. Too much of the custodian's time is spent tending the fires and handling coal and ashes. Also, it would mean enlarging the present furnace room. Dismantling the old furnaces and installing an entirely new heating system was out of the question because of the limited budget.

Thus, the selection narrowed down to some kind of separate system. After considering the several types available, it was found that a warm air system could be installed for 30% less than a steam or hot water system.

RESULTS: Approximately equal in volume to the old building, except for an auditorium and gymnasium, the new structure is heated for about 27% of the amount spent on the existing section—$499.00 as against $1884.00 for fuel alone. The old coal fired furnaces also needed repairs totalling $1267.00 during the same season.

With the system used, every room in the addition—there are 11 classrooms plus clinic, rest rooms and toilets—can be supplied with a constant volume of up to 100% outside air during school hours; more than enough to supply the requirements of a complete change every 10 minutes. A unique and inexpensive method of blending return and fresh air solves the problem of individual room temperature control.

Halstead & Mitchell

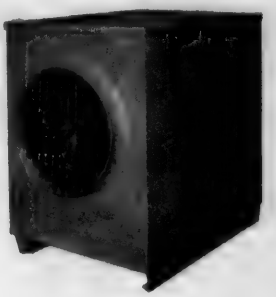
for LONG LIFE PROTECTION

COOLING TOWERS

with the exclusive

20-Year Guarantee!

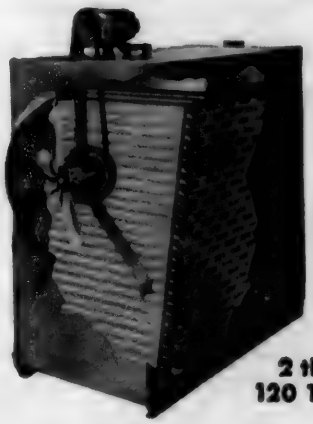
on the wetted deck surface against rotting or fungus attack



YOU ARE GUARDED WHEN YOU CHOOSE A HALSTEAD & MITCHELL RESIDENTIAL OR COMMERCIAL TOWER

Only Halstead & Mitchell can offer a 20-Year Guarantee on the wetted deck surface against rotting or fungus attack because only Halstead & Mitchell creosotes cooling tower wood. No other material, subject to deteriorating or rusting, can be so guaranteed.

Stainless steel fans, sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber . . . add to this protection for the longest life. There's no extra cost for these extra protections . . . just extra long time benefits on the job.



2 thru 120 TONS

CONDENSERS

with economical

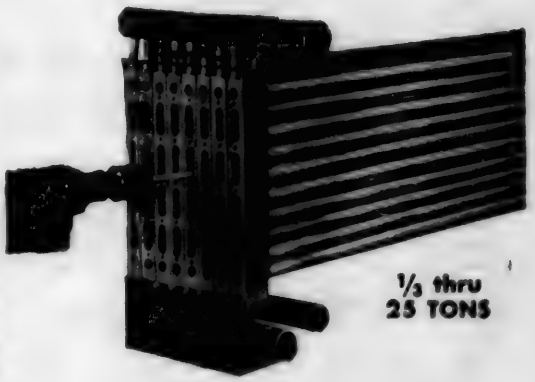
Lifetime Cleanability

for always-new efficiency

The cooling tower you select works with a condenser, and here again you are guarded by Halstead & Mitchell.

CLEANABILITY in a water-cooled condenser costs no more, but troubles from poor water conditions vanish. Heat transfer efficiency is maintained at new unit levels for life, for a simple mechanical cleaning tool restores heat transfer surfaces in minutes.

Regardless of whose condensing unit you buy, do what almost all leading manufacturers have done — specify CLEANABILITY. It's your most important protection . . . why settle for less?



⅓ thru 25 TONS

AT LEADING HEATING AND REFRIGERATION WHOLESALERS EVERYWHERE

Write for Detailed Specifications

HM Halstead & Mitchell

BESSEMER BUILDING • PITTSBURGH 22, PA.

DEGREE-DAYS FOR FEBRUARY, 1955

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

AIR CONDITIONING, HEATING AND VENTILATING's 27th Year of Publication of Monthly Degree-Day Data

City	February			Season to Feb. 28, incl.*		
	1955	1954	Normal	1954-55	1953-54	Normal
Abilene, Texas (A)	471	260	479	1918	1908	2250
Albany, New York (A)	1351	1436	1179	3757	3638	5056
Albuquerque, New Mexico (A)	840	503	714	3327	3049	3441
Alpena, Michigan (C)	1216	1000	1263	5244	4876	5448
Anaconda, Montana (C)	1248	844	1164**	5412	4628	5656**
Asheville, North Carolina (C)	(a)	586	678	(a)	2940	3105
Atlanta, Georgia (A)	(a)	409	512	(a)	2131	2269
Atlantic City, New Jersey (C)	849	674	829	3414	2931	3331
Augusta, Georgia (A)	(a)	354	412	(a)	1898	1768
Baltimore, Maryland (C)	(a)	565	776	(a)	2738	3193
Billings, Montana (A)	1243	684	1089	4665	4214	5133
Binghamton, New York (C)	(a)	842	1100	(a)	4172	4735
Birmingham, Alabama (A)	(a)	381	491	(a)	2105	2252
Bismarck, North Dakota (A)	1586	866	1464	6096	5608	6652
Block Island, Rhode Island (A)	(a)	781	955	(a)	3364	3917
Boise, Idaho (A)	1052	727	868	4605	3674	4377
Boston, Massachusetts (A)	(a)	792	1002	(a)	3589	4123
Bozeman, Montana (C)	1269	1366	1208**	5551	3934	5897**
Buffalo, New York (A)	(a)	886	1128	(a)	4196	4777
Burlington, Iowa (A)	1060	759	1036	4506	4002	4641
Burlington, Vermont (A)	(a)	1058	1313	(a)	5057	5632
Butte, Montana (C)	1298	903	1143**	5797	4934	5635**
Cairo, Illinois (C)	681	495	683	2966	2760	3004
Charleston, South Carolina (C)	360	256	363	1622	1278	1466
Charlotte, North Carolina (A)	(a)	731	577	(a)	2314	2555
Chattanooga, Tennessee (A)	(a)	463	588	(a)	2540	2693
Cheyenne, Wyoming (A)	1165	724	1044	4805	4268	5109
Chicago, Illinois (C)	980	751	1039**	4115	3673	4401**
Cincinnati, Ohio (C)	(a)	573	812	(a)	2991	3465
Cleveland, Ohio (A)	(a)	796	1019	(a)	3803	4322
Columbia, Missouri (A)	890	617	876	3683	3330	3934
Columbia, South Carolina (A)	(a)	317	443	(a)	1688	1889
Columbus, Ohio (C)	(a)	650	907	(a)	3210	3953
Concord, New Hampshire (A)	(a)	985	1226	(a)	4780	5457
Concordia, Kansas (C)	1105	562	899	3925	3505	4091
Dallas, Texas (A)	451	232	432	1818	1770	1909
Dayton, Ohio (A)	(a)	730	941	(a)	3647	4157
Deer Lodge, Montana (C)	(a)	1237	1175**	(a)	4007	6069**
Denver, Colorado (A)	1054	589	918	4233	3531	4273
Des Moines, Iowa (A)	1195	759	1092	4744	4236	4877
Detroit, Michigan (A)	1018	876	1072	4428	4036	4600
Devils Lake, North Dakota (C)	1671	1091	1576	6730	6380	7237
Dodge City, Kansas (A)	976	535	840	3615	3341	3867
Dubuque, Iowa (A)	1230	871	1187	5243	4696	5366
Duluth, Minnesota (C)	1491	1107	1448	6520	6147	6677
Elkins, West Virginia (A)	(a)	799	910	(a)	4124	4182
El Paso, Texas (A)	543	338	445	2173	2088	2201
Ely, Nevada (A)	1313	854	1033	5692	4836	5199
Escanaba, Michigan (C)	1293	1040	1327	5492	5140	5856
Evansville, Indiana (A)	770	571	770	3483	3216	3424
Fargo, North Dakota (A)	1655	1075	1518	6537	6178	6851
Fort Smith, Arkansas (A)	624	419	571	2595	2550	2619
Fort Wayne, Indiana (A)	997	796	1036	4417	3973	4601
Fort Worth, Texas (A)	455	247	498	1852	1843	1904
Fresno, California (A)	495	422	400	2315	1988	2040
Galveston, Texas (C)	247	115	247	839	819	1005
Grand Junction, Colorado (A)	1213	674	924	4691	3819	4488
Grand Rapids, Michigan (A)	1107	898	1154	4772	4349	5033
Green Bay, Wisconsin (A)	1335	1040	1336	5736	5134	5887
Greensboro, North Carolina (A)	(a)	544	672	(a)	2763	2991
Greenville, South Carolina (A)	(a)	439	552	(a)	2217	2425
Harrisburg, Pennsylvania (A)	(a)	710	921	(a)	3563	3943
Hartford, Connecticut (A)	(a)	803	1050	(a)	3940	4494
Hatteras, North Carolina (C)	(a)	396	487	(a)	1466	1802
Havre, Montana (C)	1318	774	1291	5283	5094	6044
Helena, Montana (A)	1234	842	1165	5651	4779	5881
Houston, Texas (C)	258	109	240	959	911	1083
Huron, South Dakota (A)	———	———	1327	———	———	5927
Indianapolis, Indiana (A)	911	695	938	4132	3659	4201
Jackson, Mississippi (A)	(a)	286	405	(a)	1737	1822
Kansas City, Missouri (A)	931	541	851	3529	3218	3811
Knoxville, Tennessee (A)	(a)	497	630	(a)	2686	2844
La Crosse, Wisconsin (A)	1305	896	1280	5457	4777	5708

(a) Data not available.
*Heating season, cumulative, from Sept. 1.
**Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company. Tacoma figures through the courtesy of the Tacoma News Tribune.

[Table concluded on page 152]

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The Difficult – Time Consuming – and Specialized operations in Sheet Metal Shops are now performed on one DUCTMASTER tool in an Automatic – Easy – Fast – and Simple way.

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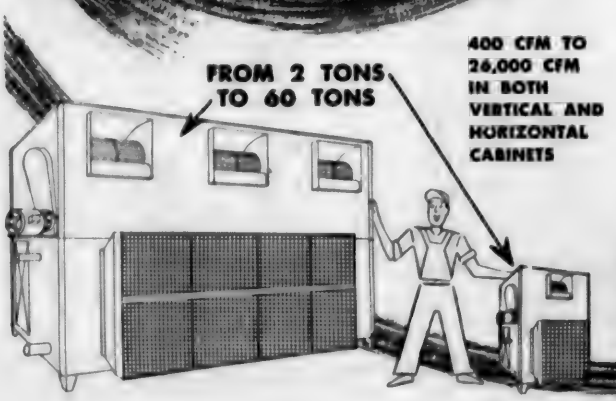

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Choose exactly what you want with Governair Air Handling Units. Secure more closely controlled balance of system load by simple selection of air handling component. 24 complete and individual sizes for greater flexibility.

OPTIONAL GOVERNAIR FEATURES:

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- **Generously sized permanent and replaceable filter sections**
- **Mixing boxes**
- **Spray and pan type humidifiers**

Manufacturers of Multi-zoned Air Handling Units, Packaged Air Conditioners, Evaporative Condensers, Cooling Towers, Blast Coils, and many others. Write for complete information and specifications.

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GOVERNAIR CORPORATION • 513 N. Blackwelder
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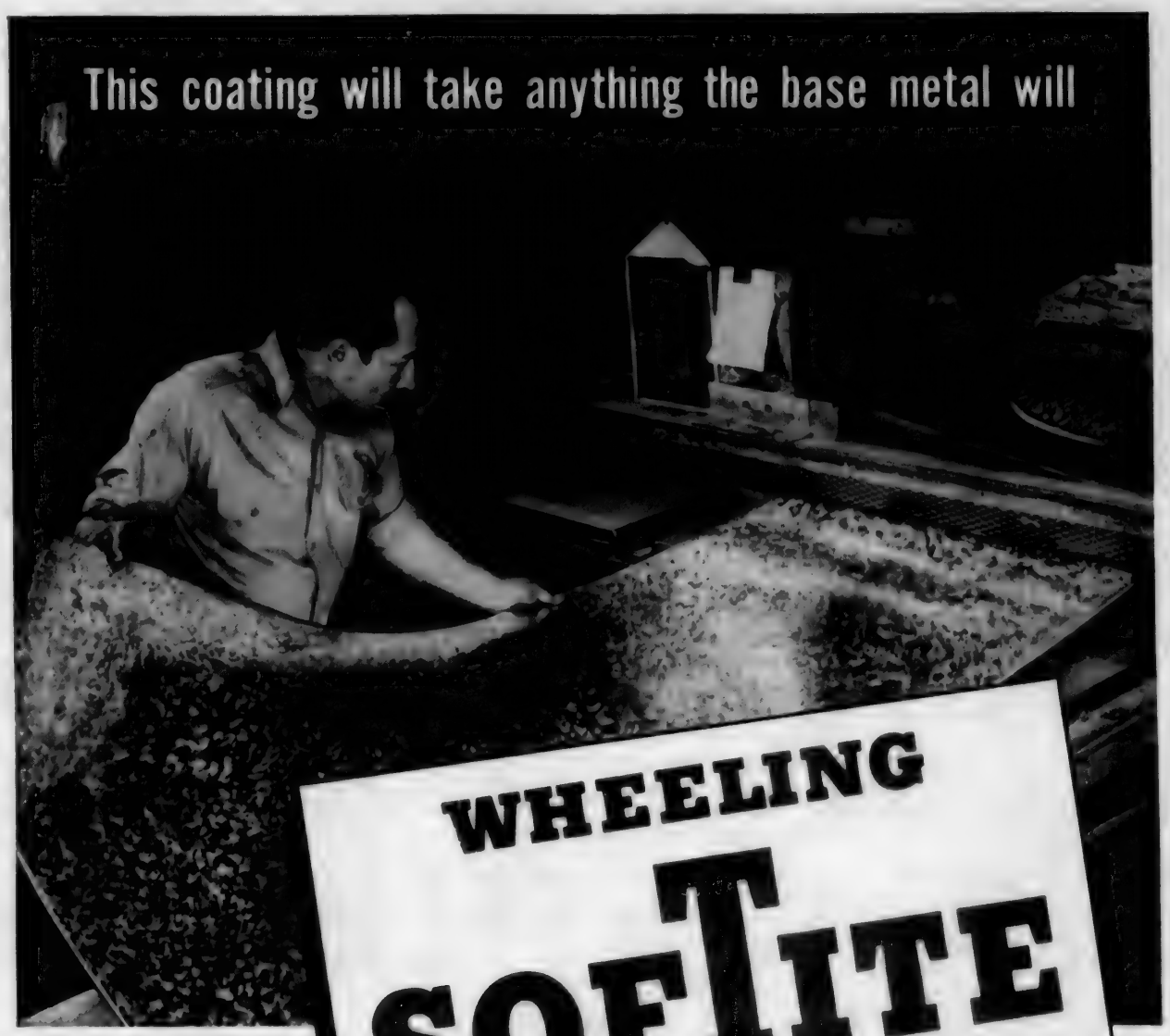
Degree-Days for February, 1955 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 27th Year of Publication of Monthly Degree-Day Data

City	February			Season to Feb. 28, incl.*		
	1955	1954	Normal	1954-55	1953-54	Normal
Lander, Wyoming (A)	1290	797	1179	5322	4617	5982
Lewiston, Maine (O)	1139	1013	1243**	5158	4986	5532**
Lincoln, Nebraska (C)	1182	637	1000	4357	3884	4483
Little Rock, Arkansas (A)	570	372	543	2399	2286	2441
Livingston, Montana (C)	1151	738	1067**	5009	4449	5018**
Los Angeles, California (C)	223	98	244	892	693	1023
Louisville, Kentucky (A)	(a)	567	778	(a)	3093	3444
Lynchburg, Virginia (A)	(a)	588	722	(a)	2932	3193
Macon, Georgia (A)	(a)	299	391	(a)	1657	1712
Madison, Wisconsin (C)	1220	895	1207	5173	4584	5331
Marquette, Michigan (C)	1248	1005	1291	5511	5065	5737
Memphis, Tennessee (A)	(a)	399	574	(a)	2343	2547
Meridian, Mississippi (A)	(a)	310	413	(a)	1865	1930
Milwaukee, Wisconsin (A)	1122	887	1142	4817	4403	5089
Minneapolis, Minnesota (A)	1411	924	1310	5746	5126	5862
Moline, Illinois (A)	1107	796	1075	4719	4179	4797
Montgomery, Alabama (A)	(a)	296	388	(a)	1690	1769
Nantucket, Massachusetts (A)	(a)	829	949	(a)	3475	3991
Nashville, Tennessee (A)	(a)	491	636	(a)	2681	2786
New Haven, Connecticut (A)	(a)	785	1005	(a)	3811	4263
New Orleans, Louisiana (C)	191	117	223	974	881	993
New York, New York (C)	841	688	904	3629	3135	3670
Newark, New Jersey (A)	(a)	707	932	(a)	3355	3883
Norfolk, Virginia (A)	(a)	508	644	(a)	2322	2630
North Platte, Nebraska (A)	1254	685	1016	5009	4345	4851
Oak Ridge, Tennessee (C)	(a)	564	(a)	(a)	2869	(a)
Oakland, California (A)	461	367	400	2084	1783	2029
Oklahoma City, Oklahoma (A)	698	359	630	2774	2546	2840
Omaha, Nebraska (A)	1230	667	1058	4467	3948	4728
Parkersburg, West Virginia (C)	(a)	625	826	(a)	3256	3599
Peoria, Illinois (A)	1030	766	1028	4393	3917	4580
Philadelphia, Pennsylvania (C)	(a)	625	837	(a)	2937	3394
Phoenix, Arizona (A)	390	114	275	1279	1140	1255
Pittsburgh, Pennsylvania (C)	(a)	685	879	(a)	3312	3761
Pittsfield, Mass. (A)	(a)	991	1212	(a)	4888	5415
Pocatello, Idaho (A)	1225	828	1022	5556	4262	5082
Portland, Maine (A)	(a)	998	1218	(a)	4829	5367
Portland, Oregon (C)	641	558	594	2897	2642	2985
Providence, Rhode Island (A)	(a)	825	1019	(a)	3876	4339
Pueblo, Colorado (A)	1038	584	865	4007	3431	3383
Raleigh, North Carolina (A)	(a)	466	577	(a)	2270	2434
Rapid City, South Dakota (A)	1274	661	1151	4882	4207	5314
Reading, Pennsylvania (C)	(a)	685	902	(a)	3343	3785
Red Bluff, California (A)	485	368	423	2279	1849	1982
Reno, Nevada (A)	916	695	804	5548	3831	4190
Richmond, Virginia (A)	(a)	556	708	(a)	2744	3068
Rochester, New York (A)	(a)	913	1148	(a)	4320	4870
Roswell, New Mexico (A)	663	407	566	2814	2648	2768
Sacramento, California (C)	453	421	403	2236	1825	1997
St. Joseph, Missouri (A)	1101	630	820	4095	3650	3646
St. Louis, Missouri (C)	794	559	792	3388	2939	3478
Salt Lake City, Utah (A)	1142	793	885	4689	3729	4358
San Antonio, Texas (A)	263	142	293	1045	1168	1355
San Diego, California (A)	260	124	247	902	753	1042
Sandusky, Ohio (C)	(a)	779	997	(a)	3642	4235
San Francisco, California (C)	350	302	336	1803	1468	1679
Sault Ste. Marie, Michigan (A)	1357	1130	1442	5999	5659	6369
Savannah, Georgia (A)	(a)	268	330	(a)	1392	1429
Scranton, Pennsylvania (C)	(a)	793	1028	(a)	3962	4423
Seattle, Washington (C)	657	548	602	2877	2797	3037
Sheridan, Wyoming (A)	(a)	731	1170	(a)	4548	5607
Shreveport, Louisiana (A)	428	240	386	1759	1689	1784
Sioux City, Iowa (A)	1336	756	1170	4971	4526	5301
Spokane, Washington (A)	1053	886	988	4794	4330	4936
Springfield, Illinois (A)	933	656	907	4066	3430	4021
Springfield, Missouri (A)	829	584	790	3457	3150	3624
Syracuse, New York (A)	(a)	893	1117	(a)	4322	4682
Tacoma, Washington (C)	683	560	636	3020	2855	3283
Toledo, Ohio (A)	(a)	822	1056	(a)	4017	4617
Topeka, Kansas (C)	1011	537	851	3699	3294	3530
Trenton, New Jersey (C)	(a)	674	904	(a)	3291	3760
Tulsa, Oklahoma (A)	665	391	644	2637	2540	2882
Utica, New York (O)	1137	950	1181**	5127	4638	4966**
Valentine, Nebraska (C)	1324	670	1100	4989	4227	5170
Walla Walla, Washington (C)	752	662	748	3521	3116	3737
Washington, D. C. (C)	(a)	583	770	(a)	2833	3258
Wichita, Kansas (A)	911	531	778	3388	3163	3564
Williston, North Dakota (C)	1561	896	1442	5988	5636	6642
Winnemucca, Nevada (A)	1056	741	854	5252	4101	4602
Yakima, Washington (A)	843	809	862	4308	4028	4512

For footnotes, see page 150.



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NEWS OF THE MONTH

CHICAGO SMOKE

to come under scrutiny of Armour Research team in $100,000 two-year project.

The Midwestern Air Pollution Prevention Association intends to raise $100,000 for a two-year research program into the sources of Chicago's air pollution problem. Details of the plan were outlined by the association's president, Dr. Haldon A. Leedy, vice president and director of Armour Research Foundation of Illinois Institute of Technology, Chicago.

Speaking at a luncheon meeting of the Crerar Library Associates, an advisory group of Chicago industrialists for the technical library, Dr. Leedy said the two-year research program would make it possible for MAPPA to recommend the most feasible and most economical corrective action.

• **PROGRAM.**—An intensified research program will provide us with ammunition for a rifle-type assault on that menace which soils our clothes, wastes our fuel, and threatens to impair our health, he asserted. Once the sources of air contamination are determined, MAPPA intends to conduct a widespread educational program designed to enlist the public's support in controlling air pollution. He pointed out that anti-pollution legislation and smoke abatement devices have been helpful in reducing air pollution, but that no permanent solution is possible without knowledge of the underlying causes of atmospheric pollution.

• **STUDY.**—Armour Research Foundation recently completed a $20,000 study for MAPPA. The investigation included a limited analytical study of Chicago's settled dust, and a partial statistical survey of the city's smoke violation reports. The project provided for study of some of the pollutants in Chicago's atmosphere, but little more than a superficial look at the sources of air pollution, according to Dr. Leedy.

• **SOURCES.**—Air pollution in Chicago is the result of the many activities necessary in a modern industrial city and, as such, is of a heterogeneous nature, he stated. Because of the complex nature of the problem, MAPPA has organized its research program to obtain a clearer definition of the factors involved. He pointed out that Chicago's monthly dustfall averaged 56 tons per square mile during 1954—about 23 tons less per square mile than in 1946, but 2 tons more than in 1953. There has been relatively little change in the dustfall figures during the last few years, despite some progress in controlling the city's air pollution.

This can be attributed, to a large degree, to pollution resulting from more residential and commercial heating units and the expanding activities of industry in the Chicago area.

Dr. Leedy estimated that about a half billion pounds of dust fall on Chicago each year. That's about 100 pounds for each inhabitant, or enough to form a 1/64th-inch layer of dust over the entire city. He does not believe that air pollution poses an immediate threat to the health of Chicagoans, but he does feel that continued contamination could have a harmful effect, as it did in Los Angeles.

Contrary to popular belief, Dr. Leedy said, the largest contributor to air pollution is the average citizen—not industry. Thousands of home and small-apartment furnaces, and the millions of automobiles, trucks, and buses, produce far more air pollution than does the industry of Chicago, he declared.

"Controlling air pollution is like voting. Each of us can make only a small contribution, yet the final result depends on the sum total of our individual contributions."

CENTURY OF BUSINESS

celebrated by Crane Co. founded as one-man shop July 4, 1855.

A century of growth that parallels the advance of U. S. industry and living conditions over the past 100 years is being reviewed and celebrated in 1955 by Crane Co., world's largest manufacturer of valves and fittings and producer of kitchen, bathroom and heating equipment.

• **BEGINNING.**—Crane Co. had its beginning on the Fourth of July, 1855, when Richard Teller Crane, 23, opened a one-man, self-built frame shop in Chicago, a bustling city of 75,000 persons.

Then there was no plumbing industry to speak of, very little valve and fitting business and only a primitive heating field.

In the R. T. Crane Brass and Bell Foundry, as the company was originally called, young Crane first produced

(*Continued on page* 156)

John L. Holloway, president of Crane Co., meets with Glenn Langan, Hollywood actor who portrays Richard Teller Crane, the company founder, in a sound and color Centennial movie. They are seated in an exact replica of Mr. Crane's office as it looked in 1871, built for the film. The job of recreating the office was simplified by using the original rolltop desk and two chairs that have been carefully preserved at Crane's Chicago Works along with other possessions of the founder.

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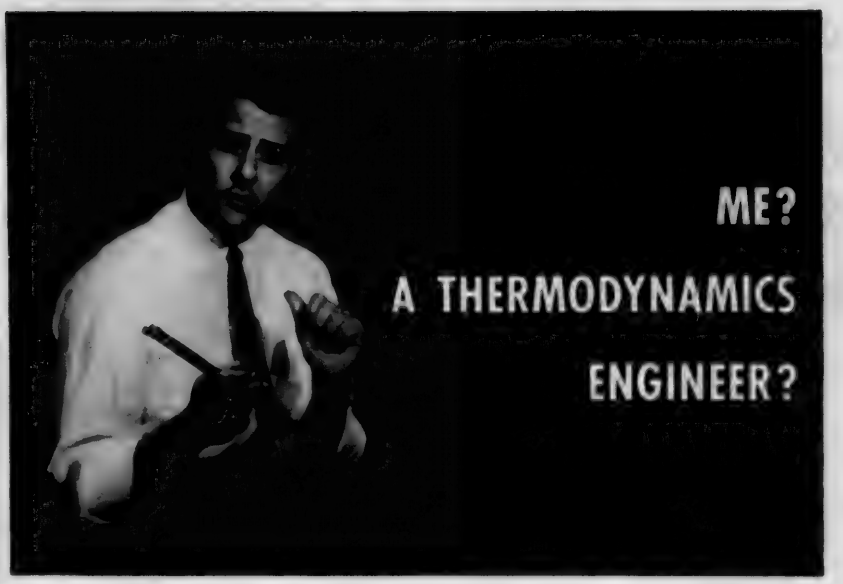

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The step up to Aeronautical Thermodynamics work isn't as steep as you might expect. Aircraft experience isn't necessary. Lockheed takes your knowledge of engineering principles, your experience in other engineering fields, your aptitude and trains you for aircraft work through a program adapted to the individual.

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These opportunities for engineers in all fields have been created by the largest development program in Lockheed's history. Projects include: jet and turboprop transports; supersonic fighters far exceeding present aircraft in performance; advanced versions of vertical rising aircraft, jet trainers and bombers; nuclear applications to aircraft; and a large number of significant classified projects.

From a career standpoint, it is significant that much of Lockheed's development program involves commercial aircraft.

Equally important is the better life you lead in Southern California. Year-round sunshine, varied cultural and recreational opportunities, and scenic beauty of San Fernando valley provide the ideal background for modern living.

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Dear Sir: Please send me your brochure describing life and work at Lockheed in Southern California

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My present field of engineering _____

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My city and state _____

CENTURY OF BUSINESS

(*Continued from page* 154)

brass couplings and copper tips for lightning rods, articles much in demand in those days.

The company became a manufacturer of valves and fittings, making its own castings. In a few decades it took seriously to the science of metallurgy and became expert in alloying metals. In the 1920's it began the manufacture of plumbing fixtures and a few years later pioneered color in these fixtures.

• **DIVERSIFIED.**—Late in 1953, Crane broke ground for a plant in Chattanooga, Tenn., to produce titanium sponge and ingots. Titanium is a lightweight, corrosion resistant metal. The plant will be operated by a subsidiary company, Cramet, Inc., a contraction of Crane Metals. Its dedication will be a feature of the company's centennial observance.

A sound and color film telling the Crane story has been produced and showings are planned to Crane employees, shareholders, customers and trade groups. In addition, the movie will be shown on television and to clubs, churches and organizations of all kinds.

Crane valves and airplane accessory equipment, manufactured by its aviation subsidiary, Hydro-Aire, Inc., are to be found on every jet, bomber, fighter and transport.

• **FUTURE.**—How does the future look to a company that has 100 years of background from which to forecast? President Holloway summed it up in a statement at the end of 1954 when he said:

"Only a relatively few years ago, business growth merely meant selling more of the same products—perhaps to more people, or getting the prices down so that the same products could be sold to lower income groups. While that is still necessary, our economy has become so complex that there is an additional requirement.

"Today growth involves diversification, taking on new related lines or adding entirely new products. This helps create new markets instead of just saturating markets that already exist. It not only helps industry grow, but keeps it stable.

"It seems to me that this is at least part of the solution we have been looking for to insure economic stabilization. As each year passes, we now find the fluctuations in the economy are less sweeping. I believe the trend will continue so that dips will become less serious. This kind of stabilization may mean that the rises will be less spectacular as well, but that, too, is to our benefit. It means that industry can finally settle down to steady growth—so steady that it can be safely planned for."

COOLING-HEATING ECONOMICS

outlined from standpoint of U. S. climate and population by chairman at air conditioning meeting.

In closing remarks at the residential air conditioner conference held during the 50th Annual Convention of ASRE in Philadelphia, Chairman Herbert L. Laube, president of Remington Corp., Auburn, N. Y., analyzed commercial opportunities and technical problems of engineers in the heating and air conditioning fields. A large part of Mr. Laube's talk concerned the climatic and economic factors affecting both the residential and commercial-industrial markets.

• **WEATHER-ECONOMICS.**—The average home owner, irrespective of his location, wants from what he buys, an acceptable balance between the first cost, the operating cost and the utility to him, said Mr. Laube. How, as air conditioning engineers, can we give the home owners this acceptable balance with operating requirements that vary as widely as is shown in Table 1?

Table 1.—ESTIMATED* AVERAGE ANNUAL USAGE RESIDENTIAL AIR CONDITIONING IN 25 SELECTED CITIES

City	Heating			Cooling		
	Hrs On	Hrs Off	On %	Hrs On	Hrs Off	On %
Atlanta	1100	7660	13	750	8010	9
Birmingham	950	7810	11	1300	7460	15
Boston	1800	6960	21	200	8560	2
Chicago	1700	7060	19	400	8360	5
Cincinnati	1550	7210	18	850	7910	10
Dallas	750	8010	9	1400	7360	16
Detroit	1750	7010	20	450	8310	5
Houston	600	8160	7	1450	7310	17
Indianapolis	1450	7310	17	800	7960	9
Jacksonville	600	8160	6	1600	7160	18
Little Rock	1000	7760	11	1200	7560	14
Los Angeles	950	7810	11	550	8210	6
Memphis	950	7810	11	1050	7710	12
Miami	120	8640	1.4	1700	7060	19
Minneapolis	1900	6860	22	350	8510	4
Mobile	650	8110	7	1300	7460	15
New Orleans	550	8210	6	1500	7260	17
New York	1650	7110	19	350	8410	4
Oklahoma City	1100	7660	13	1100	7660	13
Philadelphia	1450	7310	17	400	8360	5
Pittsburgh	1650	7110	19	400	8360	5
Raleigh	1200	7560	14	1050	7710	12
St. Louis	1400	7360	16	1000	7760	11
San Francisco	2050	6710	23	400	8360	5
Washington	1400	7360	16	800	7960	9

*Annual hours of operation for residential heating equipment computed from degree-day and design temperature tables published in 1954 Guide of the American Society of Heating and Ventilating Engineers; for cooling equipment compiled from data published by the General Electric Company, Frigidaire Division of General Motors, Remington Corporation and other industry sources.

Mr. Laube then cited a few of the high spots from this table:

(a) A reasonably designed home heating system in a San Francisco house may be expected to operate 17 times as many hours a year as does one in Miami. Obviously, the owner gets far more utility out of a heating system in San Francisco.

(b) A cooling system in a Boston house may be expected to operate an average of only 33 minutes per day on a year around basis. In Miami we can expect over 4½ hours daily operation. Thus, the fixed charges on cooling equipment in Boston are 8½ times as great, per hour of operation, as in Miami.

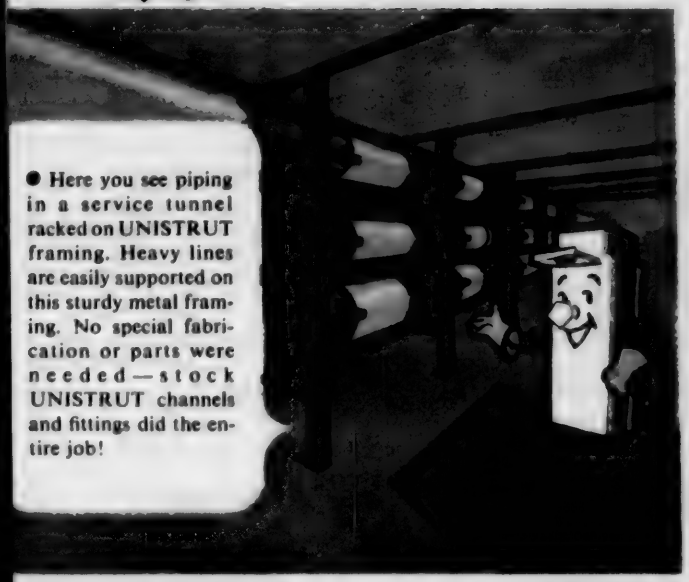
(c) Oklahoma City appears to be a "break even" location. There, heating and cooling systems may both be expected to operate 1100 hours per year, as against 200 hours of cooling and 1800 hours of heating in Boston and 1700 hours of cooling and 120 hours of heating in Miami. These figures refer to estimated hours of actual equipment operation and not the greater number of hours per

(*Continued on page* 158)

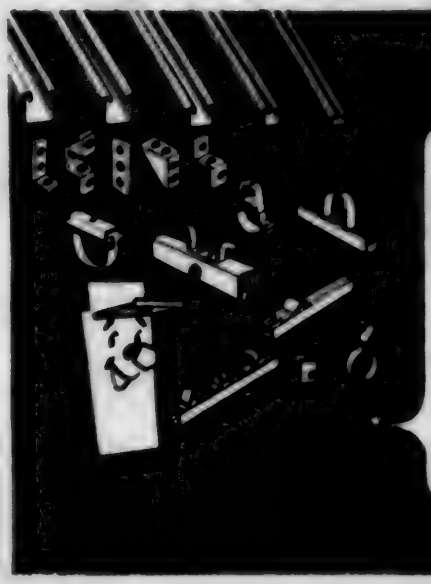
"The Sky's The Limit"

—when you build with UNISTRUT®

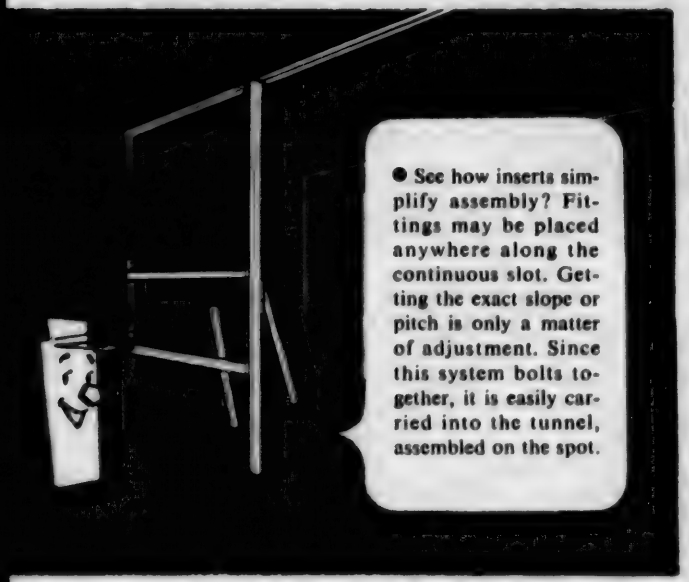
Mr. Strut simplifies pipe racking with cost-cutting UNISTRUT® framing



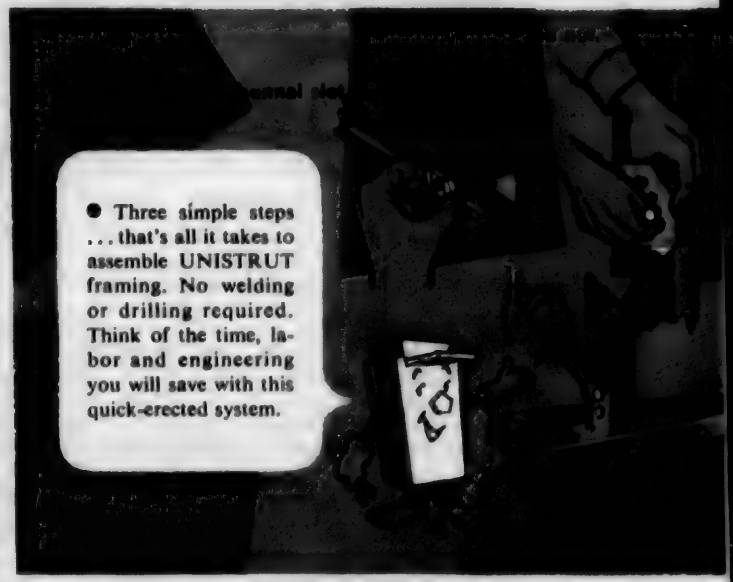
● Here you see piping in a service tunnel racked on UNISTRUT framing. Heavy lines are easily supported on this sturdy metal framing. No special fabrication or parts were needed—stock UNISTRUT channels and fittings did the entire job!



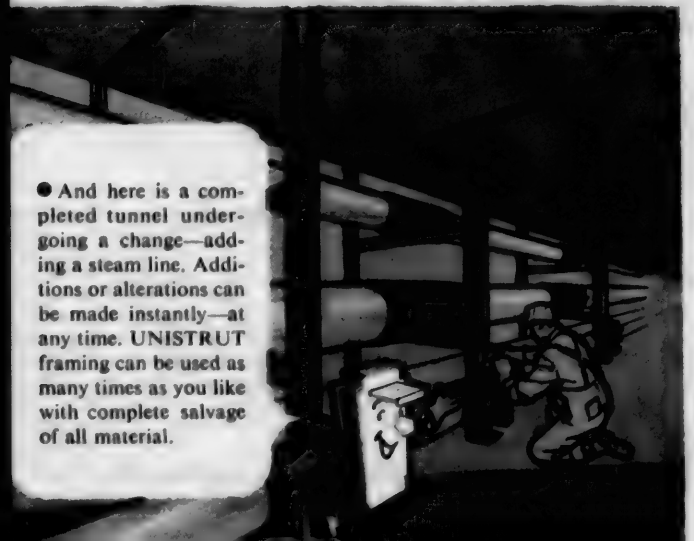
● Everything you need to rack heavy water lines to light conduit—clamps, concrete inserts, hangers, rollers and many other accessories are standard parts of the *complete* UNISTRUT system. Especially useful are these UNISTRUT concrete inserts.



● See how inserts simplify assembly? Fittings may be placed anywhere along the continuous slot. Getting the exact slope or pitch is only a matter of adjustment. Since this system bolts together, it is easily carried into the tunnel, assembled on the spot.



● Three simple steps . . . that's all it takes to assemble UNISTRUT framing. No welding or drilling required. Think of the time, labor and engineering you will save with this quick-erected system.



● And here is a completed tunnel undergoing a change—adding a steam line. Additions or alterations can be made instantly—at any time. UNISTRUT framing can be used as many times as you like with complete salvage of all material.

Why not take advantage of this versatile system on your next job? You'll find it does a faster, better job for less money. Your UNISTRUT Distributor knows this system well and can assist you in design and engineering. See him for complete information and the new low price of UNISTRUT framing. Send the coupon below for free catalogs. Make a note, too, to see our latest film "The Sky's The Limit" —now at your UNISTRUT Distributor's.

Complete warehouse stocks in all principal cities. In Canada, Northern Electric Company.

The World's Most Flexible All-Purpose Metal Framing

U. S. Patent Numbers
2327607 2388579
2329815 2408831
2345250 2541988
2363302 2606130
Other patents pending

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Chicago 7, Illinois
Dept. V-0

☐ mechanical and electrical catalog No. 700
☐ information on UNISTRUT film, "The Sky's The Limit."

Name.....

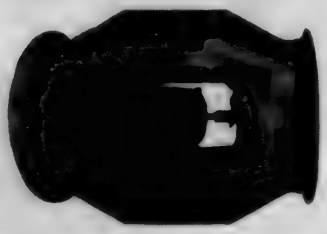
Address.....

Company.....

City.....Zone.....State.....

KODY
AXIAL FLOW
FANS

INDUCED DRAFT TYPE*



*POSITIVE DRAFT CONTROL on BOILERS and RECIRCULATION of HOT GASES in FURNACES and OVENS, ETC.

•

Glass wool insulated with a protective outer casing for temperatures to 650° F.

Water jacketed with only a trickle of water necessary, for temperatures over 650° F.

SIMPLE, ECONOMICAL INSTALLATIONS
GOOD EFFICIENCIES • WIDE RANGE OF SIZES
INCREASES BOILER CAPACITY AND EFFICIENCY
POSITIVE DRAFT CONTROL • DIRECT CONNECTED
ELIMINATES HIGH, UNSIGHTLY STACKS

KODY INDUCED DRAFT FANS are equipped with the famous Kody Axial Flow Impellers. (Available in all alloys.)

FANS FOR EVERY AIR HANDLING APPLICATION

KODY FANS are available in sizes to 60" with capacities to 85,000 cfm for a wider range of applications such as VENTILATION, COOLING, DRYING, HEATING, INDUSTRIAL PROCESSING, CHEMICAL CORROSION RESISTING, HIGH TEMPERATURES.

Write for FREE Illustrated Catalogs

A-7K

KODY BLOWER COMPANY
TRENTON, NEW JERSEY

COOLING-HEATING ECONOMICS

(*Continued from page* 156)

year during which heating or cooling may be required.

In short, it costs five to ten times as much to move a Btu out of a house as it does to move one in. Hence, home cooling that makes economic sense in one part of the country may have to cost a lot less to make good sense in another, where its annual hours of operation are much less. The more ingenuity engineers can apply to this "cost vs. utility" problem, the more quickly will they make available to marketing organizations the great potential market for home air conditioning throughout the U.S.A.

• **DESIGN.**—Skipping over the design factors which appear on every estimating form, let's list a few typical factors which the architect, the builder and the home owner may have to consider:

(a) How can I best cool my existing house which is heated with gravity warm air?

(b) Can I get ideal summer cooling conditions by using a warm air duct system which is designed to underheat the bedrooms and overheat the bathroom?

(c) How can I best cool my existing house which already has steam heat?

(d) How can I best cool my new house in which I want to use circulating hot water heat, with baseboard radiation?

(e) Knowing that warm air rises and cool air drops, am I making a compromise when I use the same duct system for both heating and cooling?

(f) Can I save money and still get satisfactory summer air conditioning with a switchover system that cools living quarters during part of the day and the bedrooms while we sleep?

(g) If I want to heat the entire house but, in order to save money, desire to cool only a part of it, how can this best be done?

The answers to these practical questions vary with the geography, the pocketbook, and, in many cases, the present heating plant and the preferences of the home owner. Our job will not soon be done. Engineers will work for many years before they get the ideal answers to each group of variables.

• **MARKET.**—Air Conditioning is forcing many with no heating background to get involved in residential heating as a part of year around equipment and systems, Mr. Laube continued. In order to get the heating and cooling functions into proper perspective, therefore, I would suggest we give some thought to the following: Of the 150,000,000 people in the U.S.A.:

(1) Almost 50,000,000 of us live where we require at least 5 hours of heating for each hour of cooling.

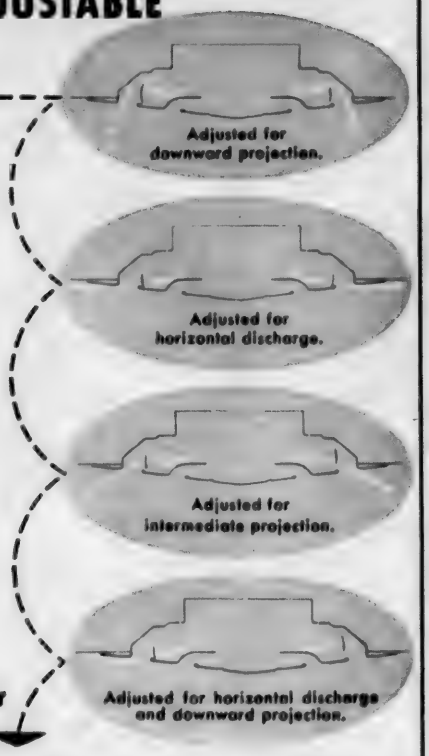
(2) Over 50,000,000 of us live where we require from 2 to 5 hours of heating for every hour of cooling.

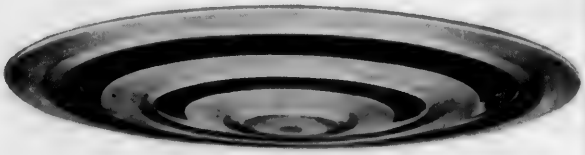
(3) 25,000,000 of us live where we require from 1 to 2 hours of heating for every hour of cooling.

(4) Only 25,000,000 of us live where we require less hours of heating than we do of cooling.

(*Continued on page* 160)

Take a look at a TRULY ADJUSTABLE Diffuser


Adjusted for downward projection.
Adjusted for horizontal discharge.
Adjusted for intermediate projection.
Adjusted for horizontal discharge and downward projection.
You Get Better Air with AGITAIR



AGITAIR®
TYPE "OA"

Here's a distinctively different diffuser with a radically new means of controlling air direction at four different angles of discharge simultaneously. *Without changing the position of the spinnings,* AGITAIR "OA" diffusers can be adjusted to put the air where you want it in one, two, three or four directions . . . *after installation.* Result: Segmentized . . . positive adjustability with Finger-Tip Air Direction Control.

Write for Bulletin C-101

Contains complete data, performance charts, construction details, etc.

AIR DEVICES INC.
185 MADISON AVENUE, NEW YORK 16, N. Y.
AIR DIFFUSERS • FILTERS • EXHAUSTERS

Carrier knows heating

Over fifty years of leadership in air conditioning have given Carrier unmatched experience in the control of temperature —heating as well as cooling. Yes, Carrier knows heating by experience—and all this engineering skill and leadership contributes to the superiority of Carrier Unit Heaters.

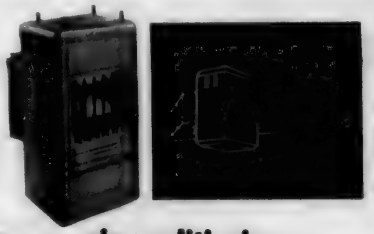
CARRIER GAS-FIRED UNIT HEATERS

begin with the outstanding midget-size Model 46T50/70, shown above. Only 23 inches high and relatively light in weight, this propeller-fan type unit heater packs a hefty 50,000 to 70,000 Btu/hr. input (according to fan-motor size). It is designed for use when both space and heating requirements are important.

And for extra-long life, only the Carrier line embodies the major advantage of 16-gauge ALUMINIZED STEEL heat exchanger. It lasts far longer than one of ordinary furnace steel of heavier gauge. The dozen or more other Carrier features are equally impressive. Six additional sizes.

Get the complete story about the full Carrier gas-fired line . . . propeller-fan and duct models ranging up to 230,000 Btu capacity. WRITE or USE COUPON for a copy of the 12-page folder on Carrier Gas-fired Unit Heaters.

Duct-type unit heaters embody all the major structural and control features of the fan-propelled model—minus fan. By-pass duct application shown here permits year-round air conditioning through the Carrier Weathermaker System. Available in seven sizes.



Carrier
air conditioning
refrigeration
industrial heating

CARRIER CORPORATION, 306 S. Geddes St., Syracuse, N. Y.
Please send me the 12-page folder on Carrier Gas-fired Unit Heaters.
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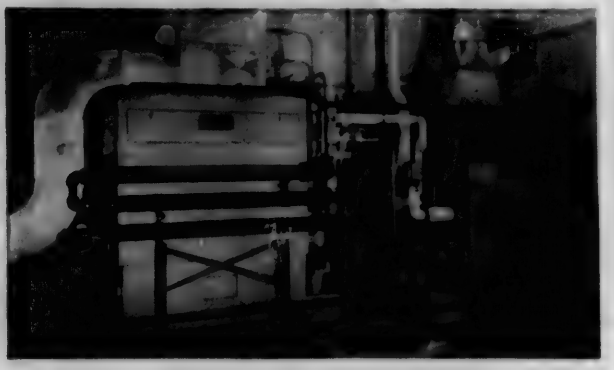
This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

For complete information write

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HV, 405 Lexington Ave. New York 17, N. Y.

Sales Engineers in Principal Cities of U. S. and Canada

COOLING-HEATING ECONOMICS

(*Continued from page* 158)

This relationship imposes on the air conditioning engineer an important obligation, Mr. Laube concluded. He must be careful not to compromise the quality of the heating system for the sake of the cooling function in those 42 states and the District of Columbia in which heating is always required for more hours per year than is cooling. If any compromising is to be done with respect to the heating function of our year around air conditioning, it should be confined to those limited areas in which the importance of cooling out-weighs the importance of heating.

COMPUTER

forecasts gas requirements for midwest utility in growing community.

How to efficiently deliver gas may be determined by an electronic brain, according to electrical engineers at Armour Research Foundation of Illinois Institute of Technology, Chicago. The Foundation's Computer Center currently is using analog and digital computers to solve problems in providing gas systems of adequate capacity in cities serviced by the Northern Illinois Gas company, in its 17-county area in northern Illinois.

• **ELECTRIC.**—Analog computers perform calculations from electrical circuits that simulate the various pipe sections, gas flows, and pressure drops, producing answers at a saving in time, according to David Rubinfien, supervisor of the center. But digital computers, he explained, work even better for gas distribution problems because solutions are more straightforward.

• **ELECTRONIC.**—With the digital computer, problems are reduced to numbers and formulas that express process operations. The equations, punched into cards, are fed into the brain for reading and retention in its memory circuits. Data, such as demand for gas and pipe sizes and lengths, are supplied. The computer then relates this knowledge with its basic information, disgorging the required operating solutions.

The electronic method not only is more accurate than the older hand method, but also is much faster. Computers, which can add as many as 500 ten-digit numbers in one second, have rendered desk calculation obsolete, Rubinfien said.

The gas company turned to electronic computing because of a boost in demand for gas which has increased five times since 1930 and two and a half times since the end of World War II.

COPPER DRAINAGE TUBE

is announced in series of sizes for soil, waste, and vent lines. Savings enumerated by spokesmen.

Widespread interest is expected to be aroused among architects, engineers, builders, contractors, plumbers and

(*Continued on page* 166)

Ad-Digest SERVICE

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

NOTE: While every attempt is made to list all advertisements, those which are received after the published closing date may not appear. The Index of Advertisers lists all the advertisments in this issue.

ALUMINUM AIR DUCT MANUAL. Page 46. An authoritative application and data handbook on aluminum ducts is published by this company. Experts of air conditioning equipment companies have cooperated with the company's engineers in its preparation. Because of its freedom from rust, the use of aluminum is advantageous in ducts used for air cooling as well as heating. Write for your copy on your company letterhead. .....Item 201

INDUCED DRAFT FANS. Page 158. Axial flow induced fans for draft control on boilers and recirculation of hot gases in furnaces and ovens are made either with wool insulation for temperatures to 650 deg F. or water-jacketed for temperatures over 650 deg. The fans are equipped with axial flow impellers available in all alloys, and the fans themselves are available in sizes to 60 in. with capacities to 65,000 cfm. Illustrated catalog available. .....Item 202

REFRIGERATION CAPACITY CONTROLLERS. Back cover. Controls designed to control multiple step refrigeration installations will prevent the starting of more than one compressor at a time after night shut-down, or after current failure. The controls respond to changes in pressure from a pneumatic thermostat or other regulator, and actuate a number of separately adjustable switches. They are made in 4, 6, 8, and 12-switch models, with or without special features. Apparatus bulletin available. .....Item 203

LOW PRESSURE PIPE INSULATION. Page 71. A low pressure pipe insulation has been improved so that it can't shrink, will not buckle or sag, and will not rot or corrode. The insulation comes in pre-formed sections for standard pipe up to 12 in. in diameter and copper tubing up to 3 in. It is furnished with a factory-applied vapor barrier for cold water or dual temperature lines. Technical bulletin is available. .....Item 204

STEAM TRAPS. Page 82. Steam traps made from 25 in. vacuum to 900 lb. pressure are available in six different series. The six different series include one trap for 15 lb to 25 in. vacuum, one for pressures up to 30 lb, another for pressures to 150 lb, one for pressures up to 250 lb, and one with a body and cover of special steel for pressures between 400 and 900 lbs. Bulletin available. .....Item 205

HEATING AND PIPING SERVICE. Page 72. This company offers a complete heating and piping service with the equipment it manufactures. Among its equipment are suction oil heaters, fuel oil preheaters, expansion joints, pipe line accessories, instantaneous water heaters, and storage water heaters. Six bulletins are available describing each of the six categories of equipment. .....Item 206

HOW-TO-DO-IT DATA SHEETS. Pages 62-63. Data sheets which tell how to increase your profit margins are offered by the manufacturer of power-actuated tools and fasteners. The sheets specify which tools, fasteners, and power chargers will do the work most effectively. .....Item 207

DEFROSTERS. Page 81. Defrosters made in horizontal and vertical models have an entirely separate defrosting circuit, which consists of a glycol pump, a cast aluminum glycol heater, a timer, and a magnetic contact. The units are available in floor-mounted or ceiling-hung models. Information available. .....Item 208

HOSPITAL AIR CONDITIONING. Pages 52-53. Seven hundred of this company's thermostats control 125 of its damper operators and 930 of its packless valves on the air conditioning units and convectors of a 1000-bed hospital that requires 1250 tons of refrigeration. The company manufactures a variety of temperature controls for heating and air conditioning systems, shower baths, hydrotherapy, X-ray film developing, water heaters, fuel oil preheaters, and other hospital applications. Write for information. .....Item 209

GALVANIZED SHEET METAL COATING. Page 153. Galvanized coating, which will take anything the base metal will, can be heated, crimped, folded, or put through any fabricating process without chipping, cracking, or flaking. The company also manufactures galvanized furnace pipe, snap-lock or close-seamed perimeter or air conditioning pipe, and accessories. .....Item 210

CONVERT STACK LOSSES INTO FUEL SAVINGS. Page 169. A draft adjustor that controls the draft automatically, can be installed and adjusted on the top, side, under the breeching, or at the base of the chimney. Sizes are made to meet every job. Bulletin available. .....Item 211

A THERMOSTAT IN EVERY ROOM. Page 67. A steam heating system that employs individual room units has a thermostat for each unit that automatically compensates for heat gains and losses caused by changes in outdoor temperature, cold winds, and warmth from the sun. A fan in each room unit is operated by a steam turbine and circulates filtered warm air. Neither the fan nor the thermostat uses electricity. Literature is available. .....Item 213

STEAM SYSTEM CONTROLS. Page 68. This company manufactures traps, valves, pumps, and other specialties to control steam systems. Among the equipment it manufactures are radiator traps, supply valves, room thermostats, motor operated valves, fuse blocks, vacuum breakers, transformers, condensation pumps, and dirt strainers. Catalogs are available on all items. .....Item 213

HOW PLANT IS VENTILATED. Page 74. A farm implement manufacturing plant is ventilated by 15 power exhausters. Twelve of the units are rated at 10,000 cfm, another at 5700 cfm, and the other two at 2800 cfm. The exhauster manufacturer makes direct drive units from 150 to 11,000 cfm and belt drive units from 2860 to 65,000 cfm, developing static pressures to 4 in. Write for information. .....Item 214

AUTOMATIC DUCT MACHINE. Page 151. Difficult time-consuming and specialized operations in sheet metal shops can be performed on one automatic machine in a fast and simple fashion. .....Item 215

AIR CONDITIONING DRIVE EQUIPMENT. Pages 12-13. Control-motor-drive combinations can be ordered from one source of supply. The components are shipped from the supplier and arrive ready to be installed. The company offers engineering help in planning the drive combination, complete stocks in authorized distributors and regional offices, and nearly 100 independent service shops which use factory-approved parts and methods. Engineering literature is available on the motors, controls, and drives. .....Item 216

ONE BOOK REFERENCE LIBRARY. Page 30. This engineering society announces the publication of its 1953 guide to heating, ventilating, and air conditioning for engineers, contractors, dealers, and manufacturers. The guide contains 53 chapters, each divided into seven sections for easier reference. It also has a catalog data section containing product information on over 325 manufacturers. .....Item 217

CONTINUOUS RIDGE VENTILATOR. Page 174. Ventilators for heavy industrial installations, where high heat or fumes require the removal of large volumes of air, are made in sizes from 4 to 96 in. The ventilator, in effect, converts the roof ridge to a giant air valve. A free data-book is available. .....Item 218

HOW TO AIR CONDITION EXISTING BUILDINGS. Page 137. Select air conditioners save the cost of installing duct systems. A choice of four distinct types helps avoid structural alterations. The types are: a console model, a ceiling model, a concealed model, and an overhead model. The same piping, water supply and return, and drain serves each unit for both the cooling and heating. Bulletin available. .....Item 219

WATER SAVING COOLING TOWER. Page 68. These cooling towers feature all-metal construction, hot-dipped galvanized steel, a blower-induced air flow, wetted metal deck principle, a cooling tower service pump, accessible parts, flush type air inlets and outlets, and full capacities. Cooling tower catalog available. .....Item 220

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE SEND US MORE INFORMATION

Circle below item numbers on which you wish further information.

201	202	203	204	205	206	207	208	209	210	211	212	213	214
215	216	217	218	219	220	221	222	223	224	225	226	227	228
229	230	231	232	233	234	235	236	237	238	239	240	241	242
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285	286	287	288	289	290	291	292	293	294	295	296	297	298
299	300	301	302										

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Street .....

City..... Zone..... State.....

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Ad-Digest

SERVICE

COPPER DRAINAGE TUBE. Page 89. Copper tube for soil, waste, and vent lines cost little or no more than an ordinary system. Three-inch copper drainage tube fits within standard partitions and eliminates costly furring-out construction. The copper tube and solder-joint fittings have no internal projections to trap waste. .....Item 201

AIR CONDITIONER FEATURES CONTROL SYSTEM. Page 86. Over-size cooling coils, accessible hermetic motor-compressor units, and a pump-down control system, which prevents compressor damage, are but a few features of this air conditioner. It is available in five capacities from 5 to 15 ton and will insure full cooling capacities and quiet operation that produces a pleasurable climate and atmosphere for any size room. Descriptive literature available. .....Item 221

FAN INSTALLS RIGHT IN DUST. Page 1. An axial flow fan in a divided housing fits right into the dust system to exhaust hot, corrosive, flammable fumes. The fan can be installed horizontally, vertically, or at an angle. It is available with fan wheels from 12 to 48 in. in diameter and with exhaust capacities up to 45,000 cfm. Free catalog available. .....Item 222

AIR DISTRIBUTION ACCENTS ARCHITECTURAL DESIGN. Page 30. This company's equipment was specified throughout the 1½-million dollar conditioned air system for a Texas county court house. Four primary systems located on the roof heat, cool, ventilate, and control humidity. Ceiling diffusers in a lobby and courtroom areas equalize the temperature differential between supply and room air. The diffusers' flange arrangement permits individual or continuous mounting. Literature, prices and engineering help available. .....Item 223

LOW COST STEAM BOILERS. Page 25. These boilers are made with four-pass construction and full 5 sq ft of heating surface per boiler horsepower, measured on the smaller ID of the tubes. A catalog is available describing 18 boiler sizes from 20 to 600 bhp; pressure to 250 psi; and burning oil or gas, or both. ...Item 224

AIR CONDITIONING HELP OFFERED. Page 28. This company offers architects, engineers and contractors, the advisory service of engineering specialists in commercial and industrial air conditioning. It also manufactures a complete range of precision-built equipment for every type of modern air conditioning system. Local service is available through a nation-wide network of personnel and facilities. Information on the service is available. .....Item 225

SOLDER AND SOCKET END VALVES. Page 91. Solder end, globe and angle, gate, and check valves are made for type K, L, and M copper tubing installation. Bronze valves with socket ends for silver-brazing are also made for class B or IPS tubing. A globe, gate, and swing check patterns. A new bulletin is available which gives instructions for soldering and brazing. .....Item 227

FAN SOLVES VENTILATING PROBLEM. Page 30. An airline overhaul and supply depot installed this vaneaxially designed fan to exhaust stale air and fumes from one of its hangars. The fan exhausts through 27 ft of tube attachable to an airplane emergency exit. It is equipped with an explosion-proof motor. Bulletin available. .....Item 228

AIR DRYING METHOD. Page 160. A method that employs a moisture absorbent liquid removes moisture from air by contact with the liquid in a small spray chamber. It removes moisture as a separate function from cooling or heating. No moisture sensitive instruments, no solids, salts, nor solutions of solids are used by the method. Information is available. .....Item 229

STEAM RADIATOR TRAPS. Page 32. Radiator traps, made with a seamless thermostatic diaphragm, have bodies of heavy cast brass suitable for pressures up to 125 lb steam. They are made in angle, straightway, vertical and left- and right-hand corner patterns. The bonnet assemblies of the given type and size are interchangeable, and the trap seats are renewable. The traps are covered in a new catalog. .....Item 230

SINGLE PACKAGE FIRING SYSTEM. Page 123. Packaged, forced draft burner unit for oil, gas, or both can convert your present boiler to automatic firing. The unit includes a burner, fuel system, forced draft air supply, control panel, and a preformed refractory combustion throat. The unit's control panel is enclosed and the instruments are wired and tested at the factory. It can be attached to the frame and turned 90 or 180 deg, or mounted elsewhere in the boiler room. Free literature available. .....Item 231

ALL GLASS TANK IS AIR CONDITIONED. Page 76. Two 150-ton packaged water chillers, of this company, were installed in the basement of a bank made with the largest panes of glass ever made in the country. The two water chillers handle the entire cooling for the new bank. They circulate water to a central air distribution system, from there cool, filtered, dehumidified air is sent throughout the building. .....Item 232

INSTRUMENT TESTS DIFFUSERS. Page 168. A direct reading air velocity meter with a 2220 jet is used by one firm to measure the actual air delivery of its diffusers in the field. The instruments are compact and portable and may be equipped with an assortment of jets and fittings. An instruction book for testing diffusers with the instrument and a bulletin are available. .....Item 233

RANGE OF CONDENSING UNITS. Page 7. This company's range of air conditioning condensing units makes it possible for you to sell your customers the right type and size of unit for their specific air conditioning requirements. Condensing units for remote air conditioning installations and compressor units for evaporative condensers are available in sizes up to 75 hp. Packaged air conditioners are available in sizes up to 30 hp for residential or business installations. .....Item 234

RESULTS OF RETRAPPING. Inside front cover. Some of the results of retrapping equipment with this company's traps are: temperatures maintained 100 deg higher in a milk dryer; the oven at a pharmaceutical plant heats up 40 minutes sooner; 30% more output from the cooking kettles of a cranberry plant; a coal consumption of another plant reduced by 400 tons annually; and 25% less trap maintenance at an electrochemical plant. A 44-page catalog is available that gives more examples of how good trapping helps users. .....Item 235

INTERIOR FIRE PROTECTION. Page 155. A complete selection of interior fire protection equipment is made by this company to meet every specification and other needs. The company also offers reliable quotations, economical pricing, and delivery as ordered. .....Item 236

AIR DIFFUSERS SOLVE PROBLEM. Page 23. A neat solution to air conditioning a department store, without disrupting sales, was worked out by one engineering firm. The air diffusers used permit the use of smaller than ordinary ducts, yet provide draftless air distribution. The company's engineers have prepared an authoritative 48-page text book on the subject of air diffusers. .....Item 237

BAKED ON TANK LININGS. Page 175. Carbon steel tanks have a baked on plastic lining in order that they may replace steel alloys and non-ferrous metals. The tanks have a heat resistance up to 500 deg F. The linings impart no color, odor, or taste to the tank's contents. The manufacturer also offers a selection of other linings, such as cement, rubber, lead, and copper to meet the many corrosion problems of industry. Free literature and information available. .....Item 238

GALVANIZED DUCT WORK STEEL. Page 29. Galvanized steel is made in modern mills and by modern methods for gutters, downspouts, and ducts. It is available in coil and cut lengths in gages of 18 to 26, inclusive. The maximum width available is 42 in., and the maximum cut length available is 168 in. For standard roofing and siding it is made to conform to ASTM specification. .....Item 239

CENTRIFUGAL PUMPS. Page 160. Centrifugal pumps for hot and chilled water circulating tasks are made with the benefit of over a full quarter-century of pump experience. The company's close-coupled pump gives dependable service even when cooling water is loaded with abrasive grit. It has a rotary type mechanical seal with a reversible ceramic floating seat and a carbon washer combination held by a stainless steel spring. Bulletin available. .....Item 240

PUSH-BUTTON HEATING. Page 65. An automatic package steam generator is push-button controlled from a single station, mounted integral with the boiler. It operates with heavy or light oils, straight gas, or combination oil and gas. The generators are available in capacities from 2070 to 10,350 lb of steam per hour. Bulletin available. .....Item 241

SPRAY DEHUMIDIFIER BULLETIN. Page 23. An 8-page bulletin is published by this company with information concerning coil-type spray dehumidifiers for washing, cleaning, humidifying, dehumidifying, heating, and cooling air volumes from 600 to 78,000 cfm. The bulletin also includes photos, sizes and dimensions of the dehumidifiers, their capacities, and engineering and construction data. The bulletin is available free on request. .....Item 242

PACKAGED AIR CONDITIONING UNITS AID ARCHITECTS. Page 134. By putting 10-ton packaged air conditioners in small rooms and a 7½-ton unit in a pent house, an architect left the entire basement of a 7-story apartment building free for rental. By equipping the packaged units with steam coils for winter heating, and by using overhead supply ducts, the architect gave his clients year-round heating and cooling for 57 cents per sq ft. Architectural data available. .....Item 243

25-YEAR OLD COAL STOKER. Page 57. An automatic coal stoker has been providing steam for a service laundry since 1926, six days a week. The stoker has mechanical drives with machine cut worms and gears that are fully enclosed and run in oil. The latest type stokers are made with an adjustable coal feed control in sizes and types for capacities up to approximately 400,000 lb of steam per hour. Write for recommendations. .....Item 244

CENTRIFUGAL PUMPS FOR AIR CONDITIONING. Page 27. Domestic and farm centrifugal pumps are being made for air conditioning applications in a range of six sizes from ½ to 3 hp, motor-mounted

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or belt-driven, and in two casing sizes. The pumps have a bronze impeller, a removable bronze wearing ring, a rotary seal, a stainless steel shaft. 3-phase capacitor type motors and a range of capacities and heads to 85 gpm and 135 ft, respectively. Performance curves and a bulletin are available. .....Item 245

ALL METAL EXHAUST FANS. Page 77. The parts of these exhaust fans that come in contact with corrosive fumes are made of solid metal. They are available in sizes, capacities, drives, and alloys to fit particular requirements. Their standard discharge arrangements include clockwise, counterclockwise, and angular arrangements which should be specified when ordering. Bulletin available. .....Item 246

REJUVENATED GATE VALVE. Page 78. In 1917, a steel gate valve was installed in the main, steam lead turbine of an electric company. It operated for 37 years under pressures of 250 psi and at 600 deg F. In 1954, when the turbine was renewed, the valve was given limited preventive maintenance while down, and re-installed in its original location. This company manufactures a complete line of steel gate valves in all pressure classes and sizes. Consult the company catalog or its representative. .....Item 247

MIDGET SIZE UNIT HEATER. Page 159. A gas fired unit heater, which is 28 in. high, is a propeller-fan type with a capacity of 50,000 to 70,000 Btu per hr input according to the fan motor size. It has a 16-gage aluminized steel heat exchanger, and is made in 6 additional sizes. The company manufactures a gas-fired line of propeller fan and duct model heaters ranging up to 230,000 Btu per hr capacity. A 12-page folder on the gas-fired unit heaters is available. .....Item 248

HIGH VELOCITY AIR DIFFUSERS. Page 73. High velocity units for hospital air conditioning can be used with smaller than conventional ducts to reduce the sheet metal required. They operate with air processed in the main equipment room and are adaptable to a wide variety of architectural designs. Write on your business letterhead for the new selection manual. .....Item 249

GAS VALVES FOR COOLING AND HEATING. Page 31. Gas valves are manufactured for the air conditioning and refrigeration industries as well as heating in ¼ to 1¼ in. sizes. Their operation is independent of gas pressure and gravity, and they may be installed close to living rooms or sleeping rooms in domestic heating units. Bulletin is available. ....Item 250

MUGGY-AIR CONTROL. Page 70. An air conditioning unit has a muggy-air control that consists of two independent refrigerant circuits. The upper circuit can be cut out, thereby increasing the dehumidifying effect by lowering the coil refrigerant temperature. Air is by-passed through the non-operating circuit and mixes with the dehumidified air to give desirable discharge temperatures. Bulletin available. .....Item 251

UNIT AIR CONDITIONERS. Page 40. Unit air conditioners built in 3, 5, and 7½-hp sizes can be adapted to the layout of stores, restaurants, hotels, offices, factories, and other businesses through the duct work. The air conditioners have insulated condensers, self-cleaning filters, and heavy construction. Distributor territories and bulletin available. ....Item 252

ON TIME DELIVERY. Page 50. This manufacturer of prefabricated, insulated piping prides itself on punctual delivery, and cautions that the best way to meet piping construction schedules is to contact the company's representative early in the planning stage. The representative will help on scheduling delivery and on technical information as well. Catalog is available. .....Item 253

COPPER TUBE FOR DRAINAGE SYSTEMS. Page 41. Copper tube for drainage systems is recommended for savings in installation time and cost and for reductions in carpentry work by pre-assembly done in the shop or on the job. Copper water tube, red brass and copper pipe, and copper refrigeration tube are also recommended by the company. .....Item 254

AIR COOLED CONDENSERS. Page 147. An air-cooled condenser is the result of years of experience in the industry. The condenser can be installed outside by being mounted on a stand on roof or remote location. It can also be installed indoors with a discharge duct to the outside, and is made in eight capacities ranging from ¾ to 10 ton. The manufacturer offers on-time delivery to contractors, even under emergency conditions. Bulletin with engineering information is available. .....Item 255

BOILER CONTROLS. Page 42. These controls are made to reduce the operating cost of coal, gas, or oil-fired boilers, either natural or induced draft. The company's selection of controls includes an automatic damper control and electric arm drive unit; a steam control that holds pressure to plus or minus 1% of required setting; gages for indicating draft, air pressure, flue gas temperature, and smoke conditions; a low draft cut-off control to prevent damage to a boiler when the draft fails; and control panel board cabinets that are factory-assembled. Detailed information is available on each of the controls. .....Item 256

CENTRIFUGAL ROOF EXHAUSTER. Inside back cover. Single, 4-zone units hausters are made in capacities up to 12,000 cfm and with a low contour design. They feature ball bearing, grease-packed motors and a spark proof fan blade. The company also manufactures wall exhausters which can be installed close to the area needing ventilation, thus reducing duct work. .....Item 257

ZONE CONTROL AIR CONDITIONING. Inside back cover. Single, 4-zone units handle different needs simultaneously in different areas. The units have a separate set of mixing dampers for each zone that permits proper balancing of conditioned air. They are equipped with filters, fans, humidifier, and coils. A bulletin is available that gives the capacities, dimensions, and descriptive details of the units. .....Item 258

AIR COOLED AIR CONDITIONER. Page 171. Air-cooled air conditioners for home and commercial use feature a specially designed condenser housing which can be attached to the unit or disconnected for remote installation. The units are also equipped with a cooling, heating switch control that can be used with standard thermostats. The self-contained unit is a 3-hp packaged air conditioner. Franchised territories available. .....Item 259

EVAPORATIVE CONDENSERS AND COOLING TOWERS. Page 54. Accessible evaporative condensers and cooling towers feature sectional construction for inspection and maintenance of sprays, coils, and tower surface. The units also have a step and platform which permit access to the top of it. They have an access port which permits access to the sump for the adjustment of the float valve and cleaning of the strainer and pan. Write for details. .....Item 260

ADJUSTABLE AIR DIFFUSERS. Page 159. This air diffuser can control the air direction at four different angles of discharge simultaneously without changing the position of the spinnings. It can be adjusted for downward projection, horizontal discharge, intermediate projection, and horizontal discharge and downward projection. Bulletin available. .....Item 261

ELECTRONIC AIR CLEANING. Page 82. Electronic precipitators are made in a range of efficiencies with a choice of maintenance methods. One model is self-cleaning and its collector plates are recoiled automatically. It has a new type of collector plates which increase the surface area 33%. Another stationary plate type electronic precipitator washes and re-oils the collector plates by two sets of traveling spray nozzles. A third model manufactured by the company is a dry type electronic filter. Four catalogs describing the company's equipment are available. .....Item 262

PUMP ENGINEERING HELP. Page 42. This company's representative or distributor will help you get the simplest and most effective possible layout. A complete range of types and sizes of air conditioning pumps are carried in stock by regional warehouses and authorized distributors throughout the country. .....Item 263

AIR HANDLING UNITS. Page 151. Air handling units are made in 24 different sizes for pinpoint selection to give closely controlled balance of a system. Condensers are available from 3 to 60 tons capacity. Company also makes multi-zoned units, packaged air conditioners, evaporative condensers, cooling towers, and blast coils. Catalog available. .....Item 264

STEEL PIPE. Page 64. You get quick service when you order steel pipe from this company's distributor. His complete stock makes it unnecessary for you to carry excess pipe inventory, or to put up with costly job delays because of lack of pipe. .....Item 265

LIQUID EYE INDICATORS. Page 166. Liquid-eye indicators feature Pyrex glass, double-sealed at the sides and ends; spring-loaded gaskets for positive sealing; and one-piece copper construction guaranteed to 500 psi. Catalog available. .....Item 266

AIR CONDITIONING CABINETS. Page 51. Horizontal and vertical units are of heavy duty construction and can be placed directly on the floor or suspended. The units, mixed flow fans can be operated at higher pressures and speeds at lower noise level. Bulletin available. ...Item 267

CHECK BEFORE YOU ORDER. Page 166. One customer has always checked with this company on any problem involving heat exchangers. Manufacturers of heat exchangers for the heating, piping, and air conditioning contractor, the company is represented in all principal trading areas. Catalog available. .....Item 268

RESIDENTIAL OR COMMERCIAL TYPE TOWERS. Page 148. The wetted deck surface of these cooling towers is guaranteed against rotting or fungus attack for 20 years. They are equipped with stainless steel fans, sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc, and chlorinated rubber. Detailed specifications available. .....Item 269

AIR FILTER GAGE. Page 177. This company's air filter gage provides a visual check of filter efficiency on any system. It determines filter efficiency the only practical and economical way: via pressure drop. The low first cost is repaid over and over through savings in replacement and service time, plus maintained optimum filter efficiency. Catalog available. .....Item 270

ELECTRIC BASEBOARD HEATER. Page 173. Located along outside walls, this heater provides perimeter heating through a combination of radiant and convected heat. It can be installed in a single room or office with two screws to hold it and two wires to connect it. Bulletin available. .....Item 271

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MECHANICAL LUNGS. Page 166. Highly flexible in purpose or position, this backward blade centrifugal fan is designed for use in heating, ventilating, and air conditioning systems, power plant installations, and industrial processes. ....Item 272

DRAFT CONTROLS. Page 167. You can eliminate heavy fuel wastes with complete safety by installing these draft controls made for commercial and industrial gas heating. Leading gas companies recommend them. Technical information and performance data are available. Item 273

UNIT OIL HEATERS. Page 170. A unit heater with 80% efficiency has a gun-type burner. Its high efficiency eliminates smoke. The heater delivers 140,000 Btu per hr and has a 50-ft throw. With thermostatic controls, it can be used as a fan in summer. One plant has 50 heaters operated off one 1-in. oil supply line in two loops. Data available. .....Item 274

ENGINEERING TRAINING OFFERED. Page 166. On-the-job training and classroom instruction in aeronautical thermodynamics is offered by this company to experienced engineers with an ME degree. You receive full pay and benefits while training. Write for the brochure describing life and work at the company's plant. .....Item 275

AIR FILTERS. Page 79. The selection of air filters is one step where it doesn't pay to save on the cost of building. For a few dollars more you can buy the right type of air filter to fit the job and be sure of cleaner air, longer service life, and lower maintenance costs for many years. Catalog available. .....Item 276

FREON COOLERS. Page 145. How this company's dry expansion Freon coolers are used in the world's largest variety store in Brooklyn. Four of the coolers, 3 in a sub-basement and 1 on the second floor, provide a total capacity of 260 tons of refrigeration. Catalog available. .....Item 277

STEAM GENERATORS. Page 75. This company's steam generator offers savings in first cost. Purchase price includes complete unit. Just set on level concrete floor and connect to service lines and breeching. Because of a minimum of supervision, lower manhour requirements for maintenance, easily replaced inexpensive plastic refractories, and 80% thermal efficiency savings in operation are also realized. Bulletin available. .....Item 278

AIR FILTERS. Page 173. No filter does all jobs, meets every need. That's why this company's filters are engineered to the job to offer more effective dust collection. This company's expanded metal face plate acts as a lint arrestor to provide easier cleaning and surfacing. It distributes air easily over the entire filter area. Bulletin available. .....Item 279

COPPER TUBING. Page 37. This company's copper pipelines are economy pipelines. They adapt easily to any plant layout and equipment. The tubes speed assembly and may be bent so you can clear beams, girders, and other obstructions, without extra joints and fittings. Booklet available. .....Item 280

BOILERS. Page 39. Top-to-bottom, inside and out, you get more money saving features when you specify or buy this company's self-contained boilers. You make an investment in quality that pays off in lowest net cost per pound of steam for processing or heating. Catalog available. .....Item 281

TANK GAGES. Page 177. Remote reading tank gages feature trouble-free design, without pulleys, springs, or other mechanical gadgets, constant accuracy with large vertical scale with interchangeable scales readily removed or adjusted to correct for tank pitch. Gages can be installed easily on tanks above or below ground and up to ¼ mile away. Bulletin available. Item 282

STEEL PIPE. Page 56. The qualities of this steel pipe are enumerated as uniformity, easy cutting and threading, it coils and bends well, makes sound joints, is strong, its manufacture is rigidly controlled, and the pipe is thoroughly tested, constantly improved, and has gained nationwide acceptance. .....Item 283

CONDENSATE PUMPS. Page 175. Condensate pumps in capacities from 500 to 10,000 sq ft EDR, available in both single and duplex units. Technical bulletin available. .....Item 284

TURBINE VENTILATORS. Page 169. Accurately rated, these wind-driven turbine ventilators are doing a noteworthy air displacing job on commercial and industrial roof tops all over the country. Ruggedly built of prime sheets of heavy-gage coated iron, these noiseless ventilators are in stock ready for immediate delivery. Catalog available. .....Item 285

OIL AND GAS BURNERS. Page 165. Low installation and maintenance costs with added years of dependable service are features of this line of gas and oil burners. .....Item 286

WATER LEVEL CONTROLS. Page 9. There is a safety device for every type and size of heating boiler and hot water plant found in schools, operating at any pressure up to 160 pounds, manufactured by this company. Included among the controls are controls for steam heating boilers, fuel cut-off requirements, high pressure steam boilers, and hot water heating boilers. Catalog available. .....Item 287

PUMP FACTS FOR AIR CONDITIONING SERVICE. Page 171. No special foundations are needed for these pumps. They operate in any position, bolt easily to the floor, wall or equipment. For smaller air conditioning installations and compact evaporative coolers, the pumps are made from ⅛ to 7½-hp sizes with mechanical seals. Immersion type pumps are built also from ⅛ to 7½-hp sizes without seals or packing. Information available. .....Item 288

FANS IMPROVED BY RESEARCH. Page 44-45. Aerodynamic research on this company's fans have made them quiet, non-overloading, and more efficient. Handling from 600 to 500,000 cfm, the fans have a sharply rising pressure characteristic throughout normal performance range. In smaller sizes, 36 in. and under, fan arrangements are convertible. Booklet available. .....Item 289

LOW WATER CUT-OFF CONTROL. Page 150. Low water cut-offs are made with a heavy Pyrex glass mercury switch, a reinforced copper float, and a large mud space float chamber bowl without ledges. The control has hook-up fittings with copper tubing for installation to the gage glass connections. Folder available describing the controls and boiler water feeders. .....Item 290

GAS UNIT HEATERS. Page 130. This company's line of gas unit heaters includes a propeller fan-type, a blower-type, a twin-fan model, and console-styled floor models. The company also announces two new duct furnaces for custom engineered heating and air conditioning systems. .....Item 291

LOW VELOCITY DIFFUSERS. Page 26. Low velocity air diffusers provide concealed, draft-free air distribution in four new office buildings. The diffusers can handle 60 air changes per hour and still maintain a low rate of room air motion. Write for new literature. .....Item 292

SCHOOL COSTS REDUCED. Pages 16-17. The use of baseboard convectors in wall hung enclosures or recessed in storage cabinets, reduce the costs of schools by savings in equipment, construction, and installation. In forced hot water heating and ventilating systems the base boards become the supply and return main to the company's cabinet models. .....Item 293

FLOAT CONTROL VALVE. Page 173. These valves for controlling water in humidifying units, and fillers, air conditioning equipment, evaporative coolers, and air washers maintain water lines as low as 1 in. deep. Two models are made, one 2¾ in. long overall and the other 3 in. long, with capacities of ⅛ gpm and 1 gpm at 50 lb pressure, respectively. ...Item 294

DUCT INSULATION AND LINING. Page 11. Duct insulation and duct liners are stocked by this company's nationwide network of distributors. Both the insulation and the liners are made of fine glass fiber and are flexible. .....Item 295

LOW PRESSURE HEATING PACKAGE. Page 14. A packaged boiler unit, which is fire-tested and shipped as a unit, has rear furnace walls, is water jacketed, and does not require a rear wall refractory. It is rated on the basis of 3.2 sq ft of heating surface per boiler hp with a gross output based on 5.0 sq ft of heating surface per boiler hp. Catalog available. .....Item 296

COPPER COOLING TUBES. Page 15. More than 6180 ft of copper water tube was used in sizes ranging from ⅜ to 2 in. in the air conditioning system of an existing hotel. The contractor was able to install the copper water tube in confined spaces by using solder fittings instead of cutting threads and using wrenches. .....Item 297

UNIT HEATERS. Page 177. Oil-fired unit heaters are manufactured by this company with outputs from 112,000 to 280,000 Btu per hr. The company has representatives in major cities. 12-page catalog available. .....Item 298

AUTOMATIC TEMPERATURE CONTROL. Page 10. Its remote type heating-cooling units are being equipped by one company with an automatic control that holds room temperature steady in summer and winter. The control maintains the temperatures by modulating the flow of either hot or cold water through the remote conditioner's coils. Information available. .....Item 299

BOILERS SERVE LIGHTING PLANT. Page 21. Two integral furnace boilers serve five buildings of a lighting company's new service center. Normally burning gas, each boiler is capable of generating 20,000 lb of steam per hr at 125 psi. Boilers of this type are available in sizes for loads ranging between 2500 and 40,000 lb of steam per hr at pressures to 235 psi. Bulletin available. .....Item 300

PUMPS AND HEAT EXCHANGERS ARE CHOSEN. Page 47. One company's pumps and heat exchangers were chosen for the heating and cooling system for the new building of an international organization. The pumps are used to circulate all water, including that in the chiller and cooling tower circuits. Water for the heating system of the building is heated with steam in the heat exchanger. .....Item 301

REFRIGERATION MOTOR CONTROLS. Page 22. Typical of the refrigeration controls made by this company are an automatic solenoid starter, a temperature control, and a special refrigeration control panel. The automatic starters for refrigeration and air conditioning service have no pivots, pins or bearings to corrode or stick and no jumpers to break. The solenoid starter is described in a bulletin. .....Item 302

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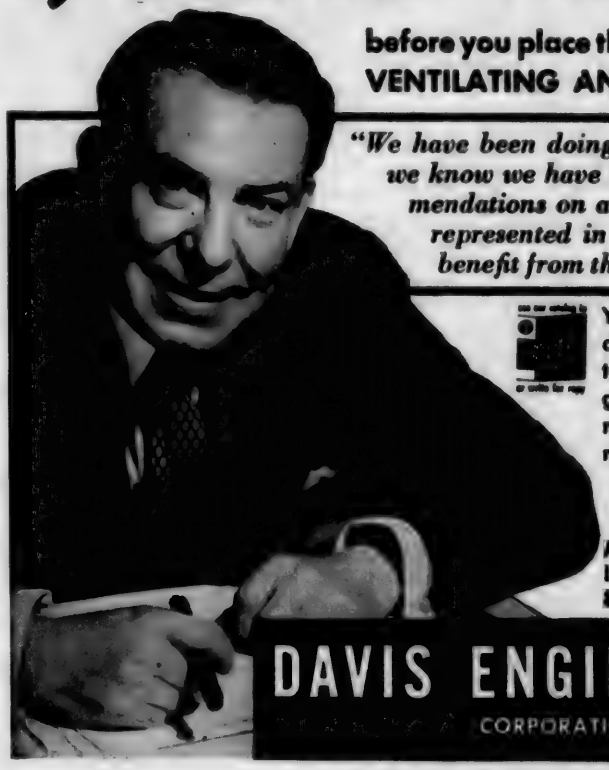

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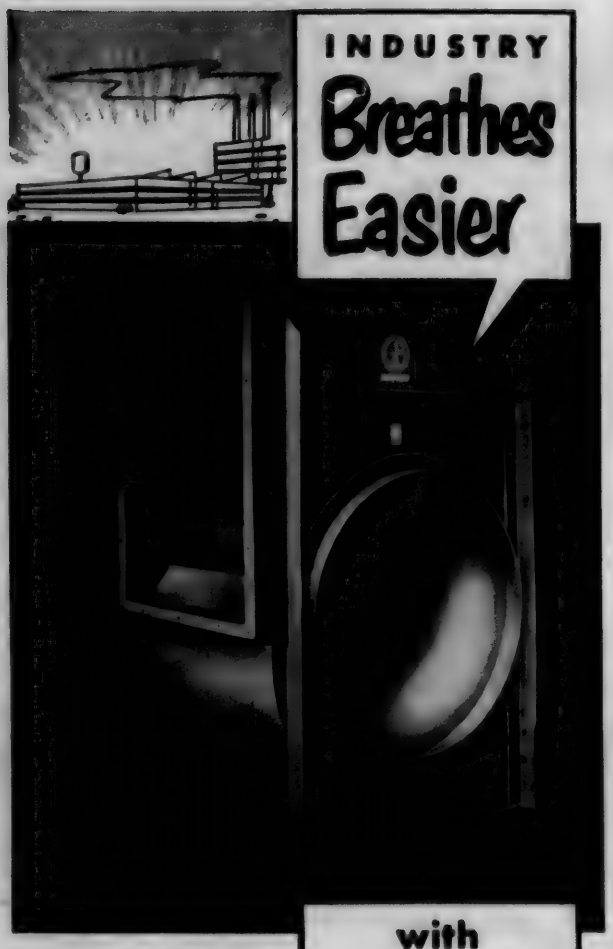

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COPPER DRAINAGE TUBE

(*Continued from page* 160)

building officials by a new copper tube series announced by T. E. Veltfort, manager of the Copper & Brass Research Association.

To be known as copper drainage tube, the new product is expected to furnish the ideal material for use in soil, waste and vent lines in modern plumbing systems. Following a comprehensive investigation by the Association and copper tube fabricators, copper drainage tube was developed specifically for sanitary drainage service. It will provide important economies for all types of building construction and, at the same time, assure a permanent installation due to the well known corrosion resistant properties of copper. Research tests have shown that copper drainage tube will provide trouble-free service for the life of a building in normal applications, the Association says. Fabricators of copper tube are commencing production of the new product.

• **FITTINGS.**—There are also available a complete line of cast brass drainage fittings conforming to American Standard ASA B16.23-1953. These fittings provide for all service conditions that may be encountered in plumbing installations. Installations with copper drainage tube provide sanitary drainage that offers smooth interiors and low frictional resistance to flow. Interior walls remain smooth throughout life of the building and clogging of copper lines is virtually unknown. Copper tube can be installed by a simple soldering operation, in which the solder is drawn into the joint by capillary action.

For an ordinary five or six-room house, the amount of material handled when installing copper is only about one-third the weight of other materials used for drainage work. Because of its lighter weight and easier procedure for joining, copper tube lends itself to shop prefabrication for larger building developments with their multiplicity of units.

Only skilled plumbers should be entrusted with the design and installation of plumbing work. Plumbing codes, either state or municipal, sometimes both, determine the standards to which the plumber's work must conform. These codes, which vary somewhat in different localities, are, as a whole, based on uniform, sound, fundamental principles of sanitation. They serve to protect the owner, the plumber and the public interest. Practical installations of copper tube for use in waste and vent lines should conform to accepted procedures for the design of plumbing.

• **SIZES.**—Copper drainage tube differs only in the wall thicknesses from the tube sizes known as copper water tube. For drainage work, where the tube is subject to little or no pressure, copper drainage tube is recommended in the standard weights and dimensions shown in Table 1.

Table 1.—COPPER DRAINAGE TUBE SIZES

Standard Size Inches	Actual Outside Diameter, Inches	Nominal Wall Thickness, Inches	Theoretical Weight, Lb. per Ft.
1¼	1.375	.040	.650
1½	1.625	0.42	.809
2	2.125	.042	1.07
3	3.125	.045	1.69
4	4.125	.058	2.87
5	5.125	.072	4.43
6	6.125	.083	6.10

In many cases 3-inch copper tube will prove adequate for the soil pipe. A 3-inch soldered fitting for copper drainage tube goes easily into the wall space provided by 2 x 4 studs. The long lengths in which copper drainage tube is available permit further economies by the elimination of many joints.

The actual selection of sizes in most instances is controlled by Code requirements, but a 3-inch copper tube stack with not over three branch intervals will accommodate 30 fixture units (not over two water closets). Where not fixed by Code, a sanitary engineer or other qualified designer would probably specify a 3-inch stack, and would undoubtedly find other instances where smaller sizes would produce savings without sacrifice of the assured satisfactory service to be obtained from the copper tube.

• **IN TALL BUILDINGS.**—Copper drainage tube may be used equally well in multi-story buildings. Typical installations of copper tube waste and vent piping for a tier of bathrooms in a tall building would probably utilize two stacks of copper with soldered fittings. The waste lines, W. C. branches and all the vents would be copper tube. The vent headers and waste lines should be long enough to take up what small expansion may occur in the stacks.

Expansion of the stacks under the most adverse temperature conditions likely to exist in such an installation is about ½ inch per 100 feet of stack length. By anchoring the stack midway between top and bottom, the maximum movement due to expansion is reduced by one half. The expansion can be taken up by the copper without special detail by keeping the cross tubing from stack to stack over five feet.

MILDER WEATHER

on Atlantic Seaboard linked to rise in frequency of hurricanes.

The Atlantic seaboard may be paying a terrible price for the warmer winters it has enjoyed since 1938, and particularly since 1948.

The same unknown factors in climate that have produced the milder winters appear to have made the seaboard vulnerable to occasional tropical hurricanes that otherwise would have bounced off and spent themselves far out to sea, members of the American Meteorological Society were told at a recent meeting.

The society's members took part in a discussion of hurricanes led by Robert H. Simpson of the United States Weather Bureau. The discussion was held at the New York Academy of Sciences, 2 East Sixty-third Street, by the academy's section on oceanography and meteorology. The session was part of a national meeting being held by the society at the Bronx campus of New York University, celebrating the centennial of the university's College of Engineering.

Jerome Namias, head of the bureau's long-range forecasting section; Gordon Dunn, new head of the bureau's hurricane forecasting station at Miami, and Mr. Simpson, who has been flying into the eyes of hurricanes for data

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since 1937, reported on the progress and prospects of hurricane research.

• **CHANGE.**—Mr. Namias said that evidence was piling up that there was a distortion of the climatic regime of the East making it advisable to consider the entire Atlantic seaboard as a hurricane area.

Further research is needed to complete the picture, he said. But the data at hand help to explain why Hurricane Carol last season raced 400 miles up the coast in twelve hours, leaving death and destruction in its wake, after taking three days to meander over 300 miles.

The southerly air flow up the Atlantic seaboard appears to have increased. At times there is a fundamental distortion of the polar trough. This arises from changes in the pattern of high altitude polar air streams in the eastern part of the United States. These polar air masses formerly put the severity in northeastern winters.

The distortion piles up air off Newfoundland and to the east. Between the two areas of high pressure—one over the northern part of the country, the other off Newfoundland—vast and powerful wind systems are set up.

These wind systems appear to have twisted into a more directly south-to-north direction. At times the hurricanes become embedded in them and are pulled northward over the Middle Atlantic and New England States.

• **FORECAST.**—Action is so fast when a hurricane like Carol starts racing northward that its probable path can be forecast in time only from observations on the climatic conditions producing the variation from the usual pattern, Mr. Namias said. That means tracking the polar air masses far to the west to tell where churning tropical air masses are likely to be drawn.

Canadian Degree Days for February, 1955*

City	February		Cumulative	
	1955	Normal	1954	Normal
Calgary, Alta.	1374	1355	5840	6666
Charlottetown, P. E. I.	1207	1338	5151	5666
Crescent Valley, B. C.	1159	1112	5393	5743
Edmonton, Alta.	1493	1501	6368	7299
Fort William, Ont.	1588	1582	7044	7204
Grande Prairie, Alta.	1568	1456	6902	7456
Halifax, N. S.	1065	1170	4427	5068
London, Ont.	1176	1240	5147	5253
Medicine Hat, Alta.	1428	1406	5646	6438
Moncton, N. B.	1234	1392	5448	6106
Montreal, P. Q.	1358	1460	5884	6108
North Bay, Ont.	1425	1492	6715	6653
Ottawa, Ont.	1367	1459	6151	6382
Penticton, B. C.	1025	969	4609	4779
Porquis Junction, Ont.	1652	1764	7798	8064
Prince George, B. C.	1288	1305	6057	6677
Quebec City, P. Q.	1417	1481	6344	6688
Regina, Sask.	1742	1764	7023	8137
St. John, N. B.	1203	1266	5371	5652
Saskatoon, Sask.	1744	1635	7054	7911
Toronto, Ont.	1073	1206	4664	5154
Vancouver, B. C.	774	736	3588	3797
Victoria, B. C.	736	689	3463	3414
Windsor, Ont.	1058	1148	4576	4877
Winnipeg, Man.	1774	1775	7285	8091

*These data are supplied through the courtesy of the Meteorological Division Air Service Branch, Department of Transport, Canada.
The Department reports slight revisions in the figures for January as published in last month's issue. Corrected figures are: Fort William, Ont., 1799; Montreal, P. Q., 1630.

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PIPING AND PLUMBING

(*Concluded from page* 121)

and small. The minimum plumbing requirements presented in these codes, represent years of research, both experimental and practical. Therefore, in order to produce the highest standard of sanitary facilities, regardless of the size of the project, the best known methods must be utilized.

Advantage of a National Plumbing Code

If a national plumbing code were in effect, it is certain that it would be the combined work of experts and it would be based on the findings of our government as well as college and university research laboratories. In addition, it would embody actual field experience and practical application. Its requirements would demand the highest caliber of design and installation procedure to insure the best sanitary measure conducive to good health.

Engineers, contractors and plumbing inspectors would quickly learn the code and could then strive to improve the design of new proposed projects. The fruits of a carefully designed project are surely of benefit to all parties concerned.

As new products and equipment are developed by manufacturers, they could be tested and accepted in reasonable periods of time. At present, when a new product is developed, years are often lost before the item is finally accepted by the responsible authority in each state, city or town.

A national plumbing code would set the high standard for plumbing design and installation which can only result in an even higher standard of health to be enjoyed by this nation. Perhaps, some day in the not too distant future, this dream for a national plumbing code will become a reality. Such an event would establish that dignified position in the advancing field of science and engineering towards which all persons connected with the plumbing field are striving.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

AIR POLLUTION SYMPOSIUM—3rd National Air Pollution Symposium, to be held at the Huntington-Sheraton Hotel, Pasadena, Calif. Director of Public Relations, Stanford Research Institute, Stanford, Calif. . . . . **APRIL 18-20, 1955.**

OIL HEAT CONVENTION—33rd annual convention of the Oil-Heat Institute of America at the Conrad Hilton Hotel, Chicago, Ill. R. H. L. Becker, secretary of the Institute, 500 Fifth Ave., New York 36, N. Y. . . . . **APRIL 19-21, 1955.**

HEATING WHOLESALERS MEETING—Spring meeting of the National Heating Wholesalers Association, at the Paradise Inn, Phoenix, Ariz. Wilbur Bull, executive secretary of the Association, 228 No. LaSalle St., Chicago, Ill. . . **APRIL 24-27, 1955.**

HEATING AND PIPING CONTRACTORS MEETING—66th annual meeting of the Heating, Piping and Air Conditioning Contractors National Association, at the Shamrock Hotel, Houston, Tex. Secretary of the Association, 30 Rockefeller Plaza, New York, N. Y. . . . . **MAY 10-13, 1955.**

AUTOMATION SYMPOSIUM—Engineering symposium on Automation—Engineering for Tomorrow to be presented by The College of Engineering, Michigan State College, as part of their Centennial Year celebration, to be held at the College. P. J. Thorsen, assistant professor of mechanical engineering, Michigan State College, East Lansing, Mich. . . . . **MAY 12-14, 1955.**

(*Concluded on page* 172)

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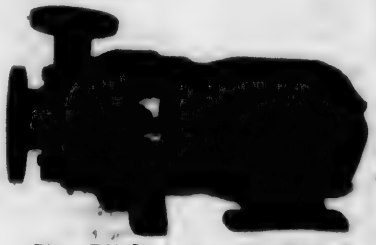

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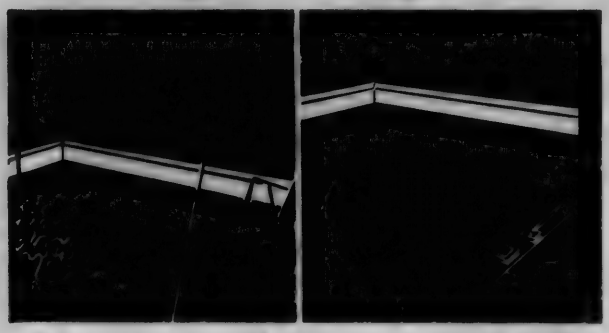

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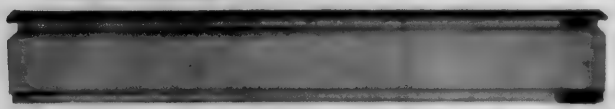

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(*Concluded from page* 170)

AIR POLLUTION MEETING—48th annual meeting of the Air Pollution Control Association, in Detroit, Mich. Harry C. Ballman, executive secretary of the Association, 4400 Fifth Ave., Pittsburgh 13, Pa. . . . . **MAY 22-26, 1955.**

GAS APPLIANCE MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at the Ambassador Hotel, Los Angeles, Calif. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. . . . . **MAY 23-25, 1955.**

NDHA MEETING— 46th annual meeting of the National District Heating Association, at the Edgewater Beach Hotel, Chicago, Ill. John F. Collins, Jr., secretary of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. . . . . **MAY 23-25, 1955.**

NAPC EXPOSITION—Annual convention and exposition of the National Association of Plumbing Contractors, Inc., to be held at Navy Pier, Chicago, Ill. W. F. Clucas, executive secretary of the Association, 1016 20th, N. W., Washington, D. C. . . . . **JUNE 6-9, 1955.**

WELDING SOCIETY SHOW—3rd annual show of the American Welding Society at Municipal Auditorium, Kansas City, Mo., to be held in conjunction with the Society's annual spring technical meeting. Joseph G. Magrath, national secretary of the Society, 33 W. 39th St., New York 18, N. Y. . . . . **JUNE 7-10, 1955.**

ASRE SPRING MEETING—Spring meeting of the American Society of Refrigerating Engineers, at the Hotel Schroeder, Milwaukee, Wis. R. C. Cross, secretary of the Society, 234 Fifth Ave., New York 1, N. Y. . . . . **JUNE 12-15, 1955.**

AUTOMOTIVE ENGINEERS MEETING — SAE Golden Anniversary summer meeting of the Society of Automotive Engineers, at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Society, 29 W. 39th St., New York 18, N. Y. . . . . **JUNE 12-17, 1955.**

TESTING MATERIALS MEETING—Annual meeting of the American Society for Testing Materials, at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Society, 1916 Race St., Philadelphia, Pa. . . . . **JUNE 26-JULY 1, 1955.**

ASHAE MEETING—The semi-annual meeting of the American Society of Heating and Air-Conditioning Engineers in San Francisco, Calif. A. V. Hutchinson, executive secretary of the Society, 62 Worth St., New York 13, N. Y. . . . . **JUNE 27-29, 1955.**

INTERNATIONAL CONGRESS OF REFRIGERATION—Ninth International Congress of Refrigeration, sponsored by the International Institute of Refrigeration, to be held in the conference rooms of the Sorbonne in Paris, France. General Secretariat of the Congress, International Institute of Refrigeration, 177, Boulevard Malesherbes, Paris, France . . . . . **AUGUST 31-SEPTEMBER 15, 1955.**

INSTRUMENT SOCIETY CONFERENCE—Tenth Annual Conference and Exhibit of the Instrument Society of America, to be held at Shrine Exposition Hall and Shrine Auditorium, Los Angeles, Calif. John McCaffery, assistant executive secretary of the Society, 1319 Allegheny Ave., Pittsburgh 33, Pa. . . . . **SEPTEMBER 12-16, 1955.**

SOLAR ENERGY SYMPOSIUM—A World Symposium on Applied Solar Energy, sponsored by Stanford Research Institute, Stanford, Calif., to be held at Phoenix, Ariz. Chairman of the Institute, 612 S. Flower St., Room 332, Los Angeles 14, Calif. . . . . **NOVEMBER 2-5, 1955.**

POWER EXPOSITION—Chicago Exposition of Power & Mechanical Engineering, at the Coliseum, Chicago, Ill., to be held under the auspices of The American Society of Mechanical Engineers, in conjunction with their 75th Anniversary meeting. E. K. Stevens, manager, International Exposition Co., Inc., 480 Lexington Ave., New York, N. Y. . . . . **NOVEMBER 14-18, 1955.**

ASRE WINTER MEETING—Winter meeting of the American Society of Refrigerating Engineers, at the Hotel Statler, New York, N. Y. R. C. Cross, secretary of the Society, 234 Fifth Ave., New York 1, N. Y. . . . . **NOVEMBER 27-30, 1955.**

REFRIGERATION EXPOSITION—9th Exposition of the Air-Conditioning and Refrigeration Industry, at Atlantic City, N. J., sponsored by the Air-Conditioning and Refrigeration Institute. The name of this trade show, formerly known as the All-Industry Refrigeration and Air Conditioning Exposition, has been officially changed. George Jones, executive secretary of the Institute, 1346 Connecticut Ave., N. W., Washington, D. C. . . . . **NOVEMBER 28—DECEMBER 1, 1955.**

NUCLEAR CONGRESS—Nuclear Congress and Atomic Exposition, sponsored by the Engineers Joint Council, to be held in Cleveland, Ohio. Stewart E. Reimel, secretary of the Council, 29 W. 39th St., New York 18, N. Y. **DECEMBER 12-17, 1955.**

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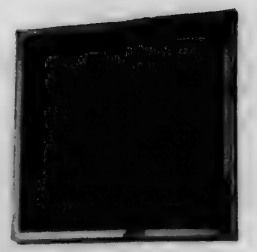

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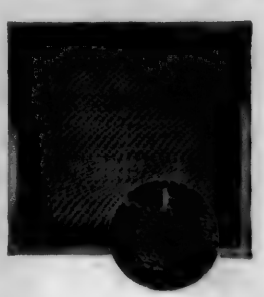

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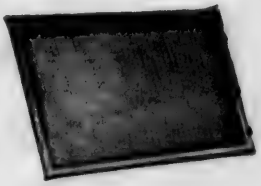

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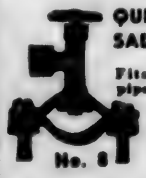

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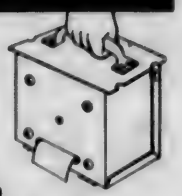

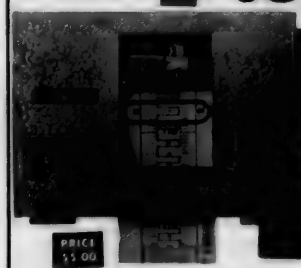

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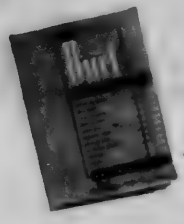

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(*Concluded from page* 113)

satisfactory still. The heat source can be either liquid Freon or hot gas, and the oil return line to the compressor crankcase should be as direct and unobstructed as possible, and approximately one-fifth the diameter of the suction line.

S. C. Deitrick
Air Conditioning Division
Westinghouse Electric Corp.

It is assumed that the system referred to uses Freon-12 as the refrigerant. In any event, a flooded evaporator will use a float type control in lieu of a thermal expansion valve. The thermal expansion valve is used in direct expansion systems. There is no superheat control on the evaporator itself except by controlling the level of the liquid. Superheat is gained by the use of a heat exchanger installed in the suction line between the evaporator and the compressor.

It is recommended that the evaporator be connected to a suction header by means of parallel risers or legs. The velocity through the legs should be not more than 250 fpm. The suction connection on top of the header may have a velocity of approximately 1500 fpm. This connection should not be immediately above one of the interconnecting legs, otherwise liquid may be swept into the suction line.

There will be oil return problems under all conditions unless a suitable means of oil recovery be installed. An efficient oil separator in the discharge line will minimize the possible oil troubles.

D. H. McCuaig
Application Engineering Manager
Air Conditioning and Refrigeration Division
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Harrison, N. J.

Answer to Previous Question

The following reply is in answer to a previous question regarding the heating of a building entrance for a combined office and industrial building. This building entrance has double doors.

Vestibule heating requires a supply of recirculated air directed across the outside door opening, heated to prevent cold drafts. The capacity of the door blanketer is a function of the frequency of wind velocity. In general, the heater unit is of sufficient heating capacity, under thermostatic control, to immediately supply an excess supply of heated air when the door is opened and recirculate air during other periods.

In practice, where the comfort of the occupants is an important factor in department stores, restaurants and office buildings, vestibule heating units are designed for a capacity of 1,000 cfm and 60,000 Btu per hour. Frequently the fan motor is selected for two-speed operations in order to permit any adjustments in mild weather.

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TVC SELECTION TABLE

Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

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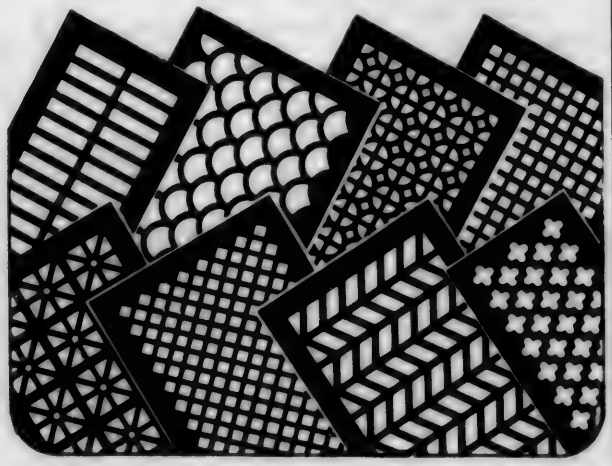

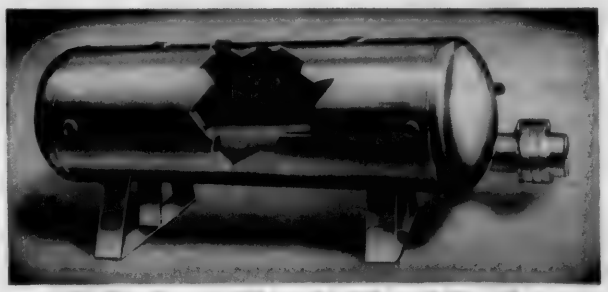

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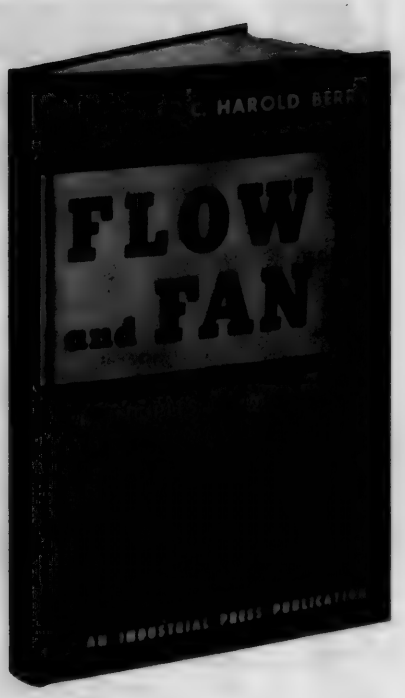

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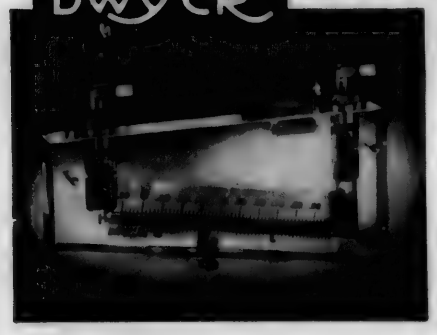

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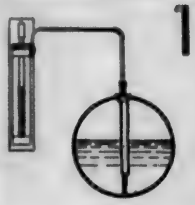

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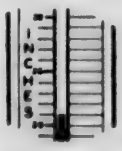

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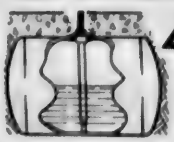

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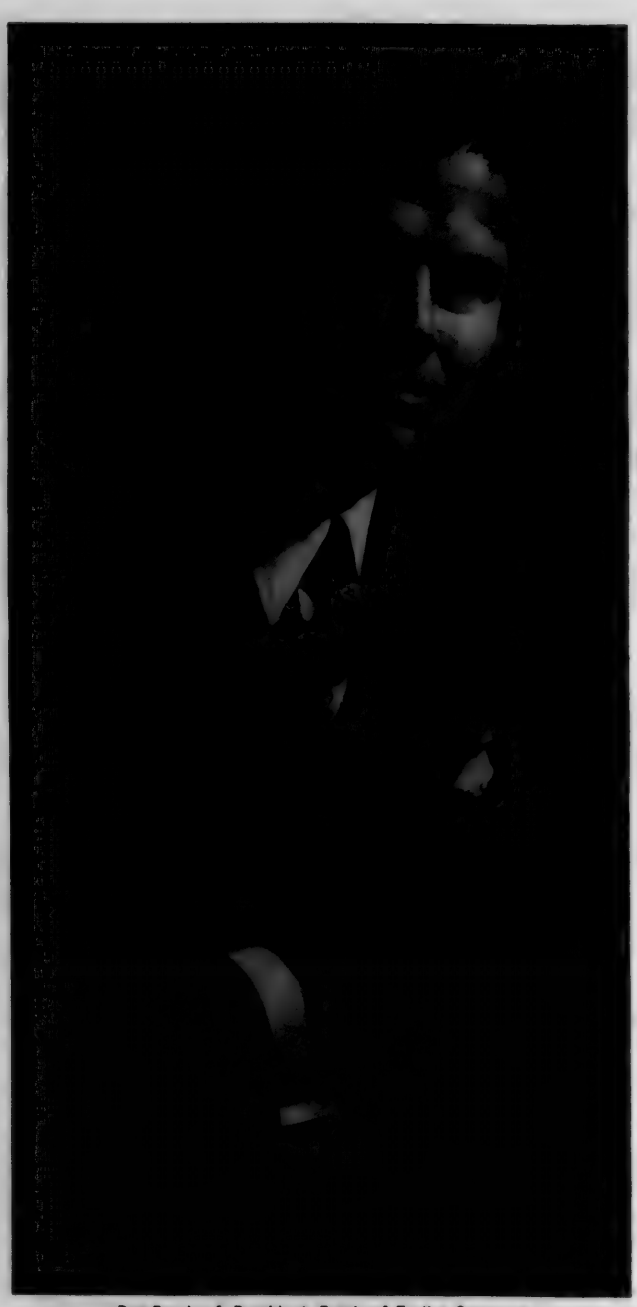

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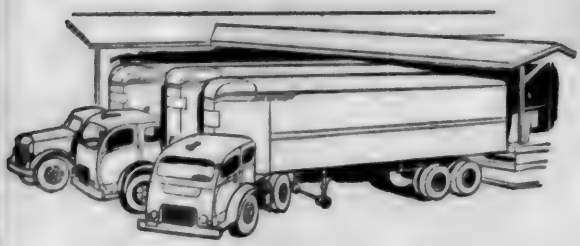

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REPRESENTATIVES WANTED

MANUFACTURERS' REPRESENTATIVES by well known Manufacturer of quality Hot Water Baseboard Radiation and heating equipment. Available territories: New York City and Long Island, South East New York State, Ohio, Western Pennsylvania, Southern, South West, Middle West, Western and North Western States. P. O. Box 301, Camden, New Jersey.

WANTED

CHIEF ENGINEER — Wonderful opportunity for advancement with fast-growing, aggressive manufacturer of fans and blowers. Will be in complete charge of design and development. Excellent opportunity for creative engineer. Plant located in progressive, modern, Midwest community. Staff knows of this ad. State experience and qualifications first letter. Reply to Box No. 849, Air Conditioning, Heating and Ventilating, 93 Worth St., New York 13, N. Y.

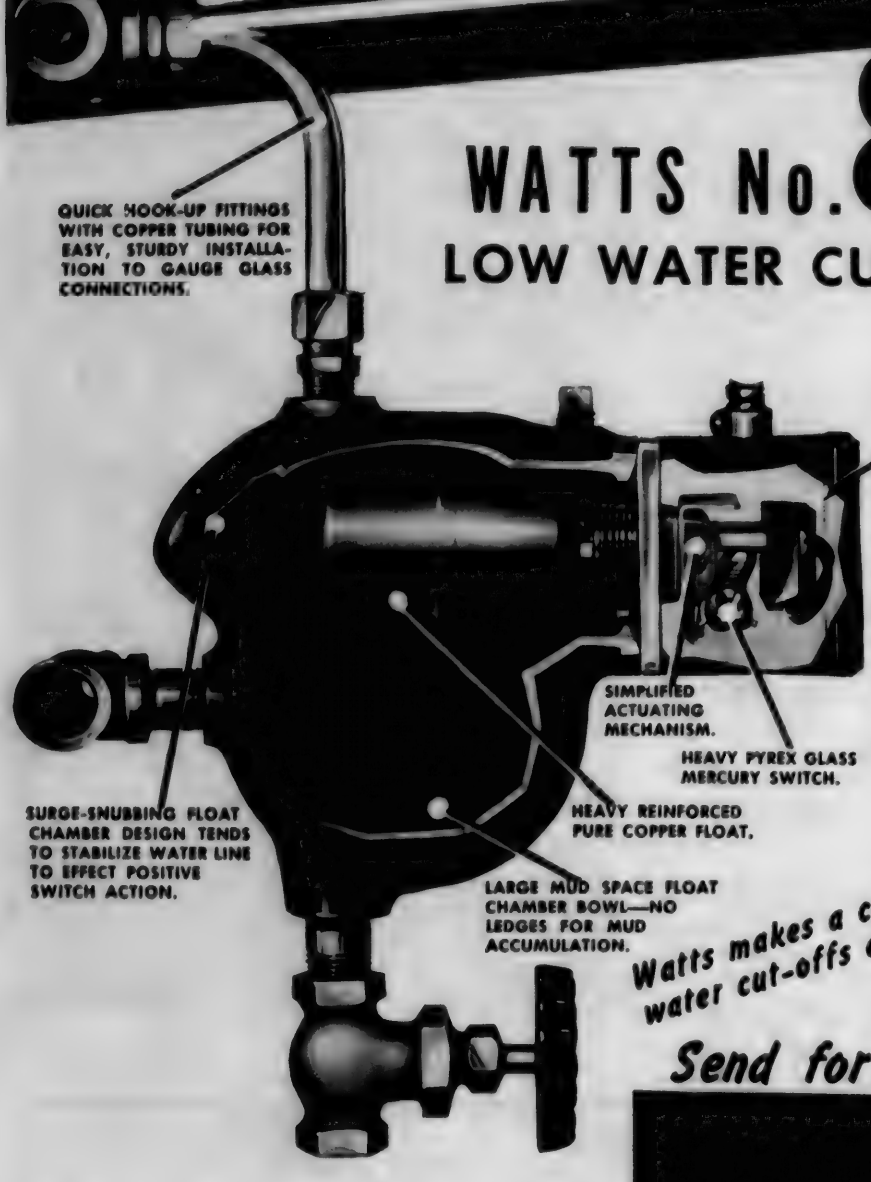
"West Coast manufacturer seeks representatives for power roof fans and ventilators. Superior design, ready to meet any and all competition. Representative must have established reputation in local territory and represent complementary lines. Send references and education and experience profile to: Hesterman Metals & Plastics Co., 778 University Ave., Berkeley 10, Cal."

CHIEF OF DEVELOPMENT

Specialized in Heat transfer coils, excellent education and 10 years experience in heating, air conditioning and refrigeration products. If you need an experienced man to head up a development program and can offer prospects, please contact Box 848, AIR CONDITIONING, HEATING & VENTILATING, 93 Worth St., New York 13, N. Y.

DEPENDABLE

WATTS No. 89A
LOW WATER CUT-OFF


QUICK HOOK-UP FITTINGS WITH COPPER TUBING FOR EASY, STURDY INSTALLATION TO GAUGE GLASS CONNECTIONS.
AMPLE WIRING SPACE WITH BARRIER TO PROTECT SWITCH MECHANISM.
SIMPLIFIED ACTUATING MECHANISM.
HEAVY PYREX GLASS MERCURY SWITCH.
HEAVY REINFORCED PURE COPPER FLOAT.
SURGE-SNUBBING FLOAT CHAMBER DESIGN TENDS TO STABILIZE WATER LINE TO EFFECT POSITIVE SWITCH ACTION.
LARGE MUD SPACE FLOAT CHAMBER BOWL—NO LEDGES FOR MUD ACCUMULATION.

Every characteristic that heating contractors and journeymen want in low water cut-offs is found in WATTS No. 89A.

Their excellence is attested by their wide acceptance.

Watts makes a complete line of low water cut-offs and boiler water feeders.

Send for...

WATTS REGULATOR COMPANY
LAWRENCE MASSACHUSETTS

"EXCELLENCE IN WORKMANSHIP"

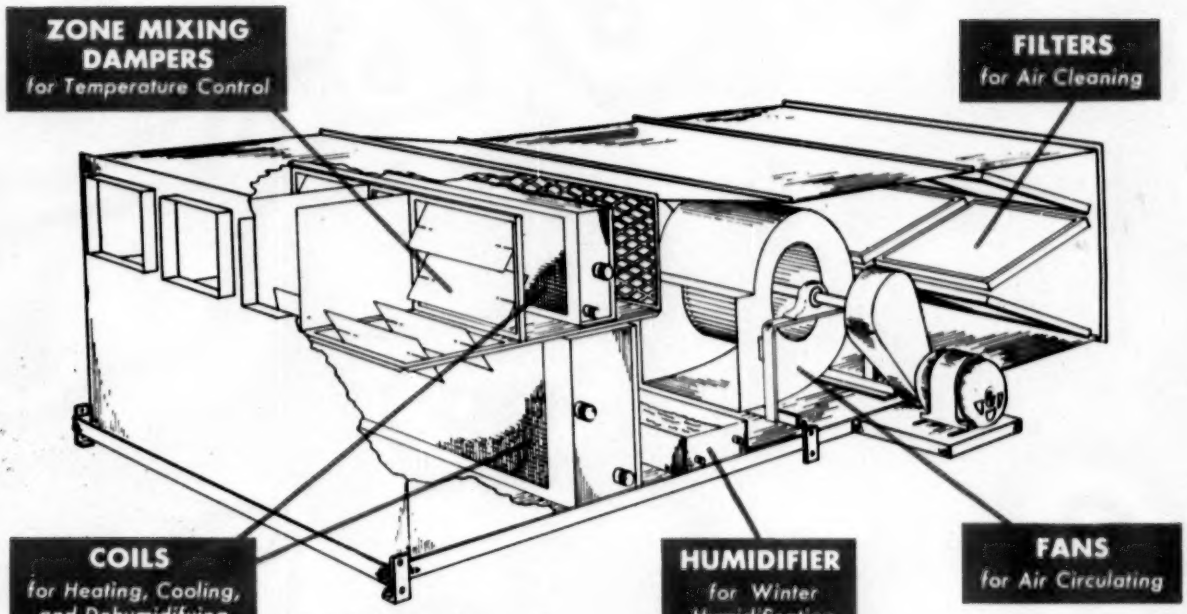
TABLES FOR DETERMINING RELATIVE HUMIDITY

Dry Bulb Temp., °F	Wet-Bulb Temperature, °F									
	30	31	32	33	34	35	36	37	38	39
	Relative Humidity, Per-Cent									
30	100.0									
31	89.1	100.0								
32	79.2	89.6	100.0							
33	70.4	80.2	90.3	100.0						
34	62.1	71.7	81.3	90.6	100.0					
35	54.4	63.6	72.8	81.7	90.8	100.0				
36	47.1	56.0	64.9	73.5	82.2	91.0	100.0			
37	40.5	49.0	57.5	65.7	74.1	82.6	91.2	100.0		
38	34.2	42.4	50.6	58.5	66.6	74.7	83.0	91.5	100.0	
39	29.1	36.2	44.1	51.7	59.5	67.3	75.3	83.4	91.6	100.0
40	22.9	30.5	38.1	45.4	52.9	60.4	68.1	75.9	83.8	91.9
41	17.9	25.2	32.5	39.5	46.7	53.9	61.3	68.8	76.4	84.2
42	13.2	20.2	27.2	32.8	40.9	47.8	55.0	62.2	69.5	76.9
43		15.6	22.3	28.8	35.4	42.2	49.0	56.0	63.0	70.1
44		11.2	17.7	24.0	30.4	36.8	43.4	50.1	56.9	63.8
45			13.5	19.5	25.7	31.9	38.2	44.7	51.1	57.8
46			9.5	15.3	21.3	27.2	33.3	39.5	45.8	52.2
47				11.4	17.1	22.9	28.8	34.7	40.8	46.9
48					13.3	18.9	24.5	30.3	36.1	42.0
49					9.7	15.1	20.5	26.0	31.6	37.3
50						11.5	16.8	22.1	27.5	33.0
51						8.2	13.3	18.4	23.6	29.0
52							10.1	15.0	20.0	25.1
53							7.0	11.8	16.6	21.6
54								8.8	13.5	18.2
55								6.0	10.5	15.1
56									7.7	12.2
57										9.4
58										6.9

Dry Bulb Temp., °F	Wet-Bulb Temperature, °F									
	40	41	42	43	44	45	46	47	48	49
	Relative Humidity, Per-Cent									
40	100.0									
41	92.0	100.0								
42	84.5	92.2	100.0							
43	77.4	84.8	92.4	100.0						
44	70.8	77.9	85.2	92.5	100.0					
45	64.5	71.4	78.4	85.5	92.7	100.0				
46	58.7	65.3	72.0	78.8	85.8	92.8	100.0			
47	53.2	59.5	66.0	72.6	79.2	86.0	93.0	100.0		
48	48.0	54.1	60.3	66.7	73.1	79.6	86.3	93.1	100.0	
49	43.1	49.0	55.0	61.1	67.3	73.6	80.1	86.6	93.2	100.0
50	38.6	44.3	50.1	55.9	61.9	68.0	74.2	80.5	86.9	93.4
51	34.3	39.8	45.3	51.0	56.8	62.6	68.6	74.7	80.8	87.1
52	30.3	35.6	40.9	46.4	51.9	57.6	63.3	69.2	75.1	81.2
53	26.5	31.6	36.8	42.1	47.4	52.8	58.4	64.0	69.8	75.5
54	23.0	27.9	32.9	38.0	43.1	48.4	53.7	59.1	64.7	70.3
55	19.7	24.4	29.3	34.1	39.1	44.2	49.3	54.6	59.9	65.3
56	16.6	21.2	25.8	30.5	35.3	40.2	45.1	50.2	55.3	60.6

Dry Bulb Temp., °F	Wet-Bulb Temperature, °F									
	40	41	42	43	44	45	46	47	48	49
	Relative Humidity, Per-Cent									
57	13.7	18.1	22.6	27.1	31.8	36.4	41.2	46.1	51.1	56.1
58	11.0	15.2	19.6	24.0	28.4	32.9	37.6	42.3	47.0	51.9
59	8.5	12.6	16.7	21.0	25.3	29.6	34.1	38.6	43.2	47.9
60	6.1	10.1	14.1	18.2	22.3	26.5	30.8	35.2	39.6	44.2
61		7.7	11.6	15.5	19.5	23.6	27.7	32.0	36.3	40.6
62		5.5	9.3	13.1	16.9	20.8	24.9	28.9	33.1	37.3
63			7.1	10.8	14.5	18.3	22.1	26.1	30.0	34.1
64			5.0	8.6	12.2	15.8	19.6	23.4	27.2	31.2
65				6.6	10.0	13.5	17.2	20.8	24.6	28.4
66				4.6	8.0	11.4	14.9	18.4	22.0	25.7
67					6.1	9.4	12.8	16.2	19.7	23.2
68					4.3	7.5	10.8	14.1	17.4	20.9
69						5.7	8.9	12.1	15.3	18.6
70						4.1	7.1	10.2	13.4	16.6
71							5.5	8.5	11.5	14.6
72							3.9	6.8	9.7	12.7
73								5.3	8.1	11.0
74								3.8	6.6	9.3
75									5.1	7.8
76									3.7	6.4
77										5.0
78										3.7

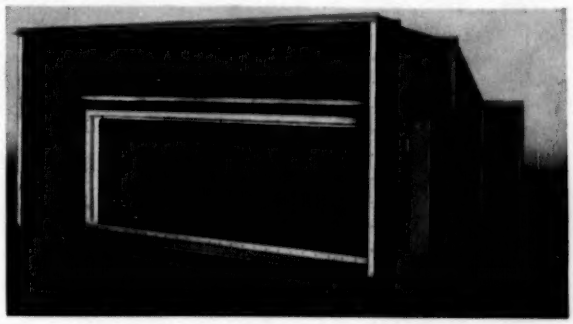
Dry Bulb Temp., °F	Wet-Bulb Temperature, °F									
	50	51	52	53	54	55	56	57	58	59
	Relative Humidity, Per-Cent									
50	100.0									
51	93.5	100.0								
52	87.3	93.6	100.0							
53	81.5	87.6	93.7	100.0						
54	76.0	81.8	87.8	93.8	100.0					
55	70.8	76.4	82.2	88.0	93.9	100.0				
56	65.9	71.3	76.8	82.5	88.2	94.0	100.0			
57	61.2	66.5	71.8	77.2	82.8	88.4	94.1	100.0		
58	56.8	61.9	67.0	72.3	77.6	83.1	88.6	94.3	100.0	
59	52.7	57.6	62.5	67.6	72.7	78.0	83.3	88.8	94.3	100.0
60	48.8	53.5	58.3	63.2	68.1	73.2	78.4	83.6	89.0	94.4
61	45.1	49.6	54.3	58.9	63.7	68.6	73.6	78.7	83.9	89.1
62	41.6	46.0	50.4	55.0	59.6	64.3	69.1	74.0	79.0	84.1
63	38.3	42.5	46.8	51.2	55.7	60.2	64.9	69.6	74.4	79.3
64	35.2	39.2	43.4	47.6	51.9	56.3	60.8	65.4	70.1	74.8
65	32.2	36.2	40.2	44.3	48.4	52.7	57.0	61.4	65.9	70.5
66	29.4	33.2	37.1	41.1	45.1	49.2	53.4	57.7	62.0	66.4
67	26.8	30.5	34.2	38.1	41.9	45.9	49.9	54.1	58.3	62.5
68	24.3	27.9	31.5	35.2	39.0	42.8	46.7	50.7	54.7	58.9
69	22.0	25.4	28.9	32.5	36.1	39.8	43.6	47.4	51.4	55.4
70	19.8	23.1	26.5	30.0	33.5	37.0	40.7	44.4	48.2	52.0
71	17.7	20.9	24.2	27.5	30.9	34.4	37.9	41.5	45.2	48.9
72	15.8	18.9	22.0	25.3	28.5	31.9	35.3	38.7	42.3	45.9
73	13.9	16.9	20.0	23.1	26.3	29.5	32.8	36.1	39.6	43.1
74	12.2	15.1	18.0	21.1	24.1	27.2	30.4	33.7	37.0	40.4
75	10.5	13.4	16.2	19.1	22.1	25.1	28.2	31.3	34.5	37.8



Typical 4-zone unit arranged for complete conditioning.

Different needs simultaneously in different areas . . . yet handled by this one unit

ZONE CONTROL AIR CONDITIONING



Front panel and mixing dampers removed to show arrangement of heating and cooling coils.

. . . pioneered and perfected by CLARAGE

Clarage Blow-Thru Multitherms are units that take variables in stride! A separate set of mixing dampers for each zone permits proper "balancing" of conditioned air according to the loads imposed by sun effect, wind, occupancy, and other factors.

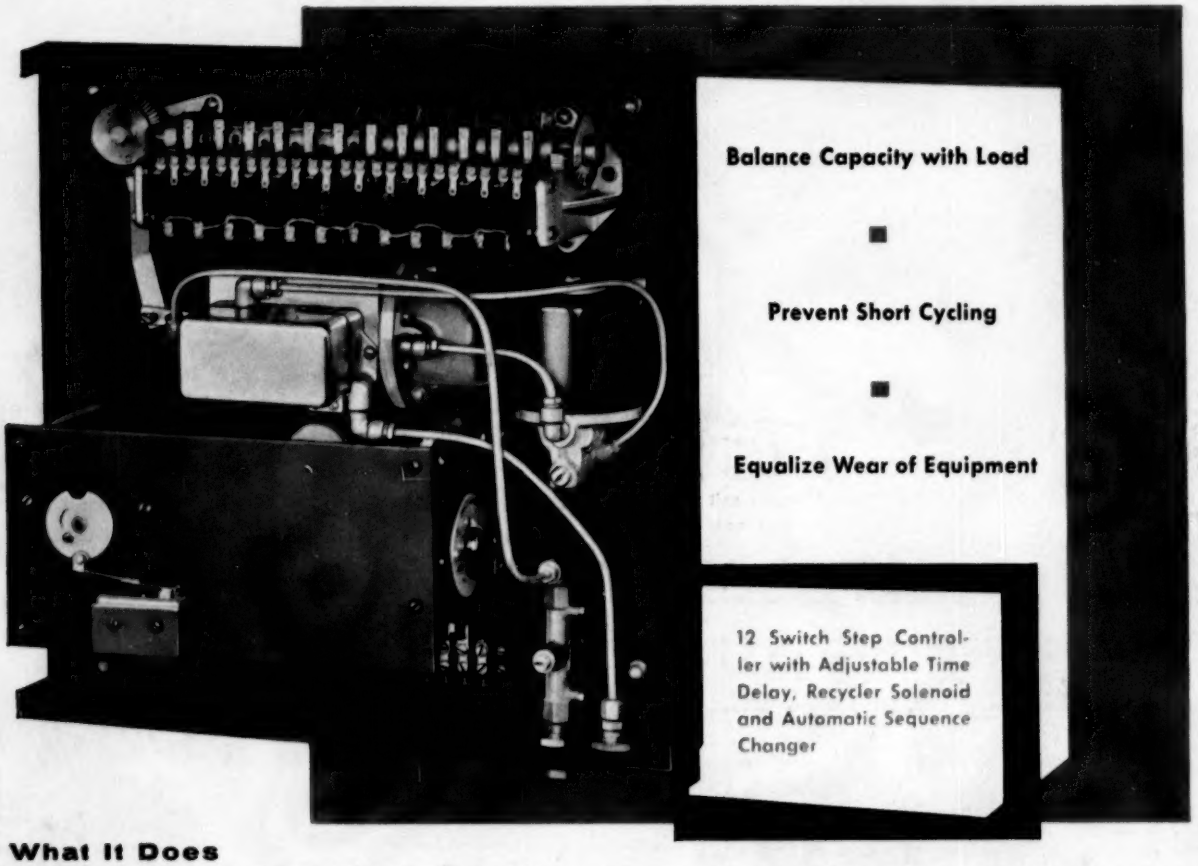
Thus, in a building of medium size, a single unit provides uniform air conditioning results with far greater economy and simplicity than possible with previous arrangements of equipment. Certainly the Blow-Thru Multitherm is a unit to investigate thoroughly for any application where simultaneously unequal loads are encountered.

A request for Bulletin 1310-A will place in your hands capacities, dimensions, and other descriptive details of Clarage Blow-Thru Multitherms. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

You can Rely on **CLARAGE** . . . dependable equipment for making air your servant

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

JOHNSON PNEUMATIC STEP CONTROLLER FOR CAPACITY CONTROL OF REFRIGERATION MACHINES


Balance Capacity with Load
Prevent Short Cycling
Equalize Wear of Equipment
12 Switch Step Controller with Adjustable Time Delay, Recycler Solenoid and Automatic Sequence Changer

What It Does

This new and improved controller is designed to accomplish, with a single compact unit, everything that is desired for the control of multiple step refrigeration installations, including "on" and "off" operation of the steps in sequence, positive prevention of the starting of more than one compressor at a time after night shutdown or after current failure, and manual or automatic changing of compressor operating sequence to equalize wear. It can be used to control one or a group of refrigeration machines. It completely eliminates all the disadvantages of a series of separate pressure switches.

How It Works

The Johnson Pneumatic Step Controller, responding to changes in control pressure from a Johnson Pneumatic Thermostat or other regulator, actuates a number of separately adjustable, snap-acting, single-pole, double-throw switches in any desired sequence. Control arrangements include (1) starting and stopping two or more compressors in sequence, (2) operation of cylinder unloaders in sequence, or (3) a combination of (1) and (2).

Special Features

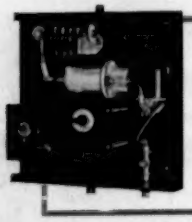
Recycler and Time Delay—Recycler Solenoid immediately returns all switches to their normal position on shutdown or current failure. Time Delay assures the proper interval between successive switch operations on start-up or when current is restored after failure.

Sequence Changer—Varies the starting sequence of compressors to equalize running time and wear. Step Controllers are furnished with either Manual or Automatic Sequence Changer.

Models—Choice of 4, 6, 8 and 12 switch units, with or without special features such as Recycler, Adjustable Time Delay and Sequence Changer.

* * *

Installation and operation of the Johnson Pneumatic Step Controller is both simple and inexpensive. A nearby Johnson engineer will gladly explain, without obligation, how it can best solve your special problems, or write today for full details.



OTHER APPLICATIONS

Johnson Step Controllers are also used to control multiple fan or pump installations, electric heaters and other systems where electrically actuated devices are to be operated in sequence from a proportional acting pneumatic controller. Send the coupon for more facts.

JOHNSON CONTROL

TEMPERATURE AIR CONDITIONING

PLANNING • MANUFACTURING • INSTALLING • SINCE 1885

JOHNSON SERVICE COMPANY
507-C East Michigan St., Milwaukee 2, Wisc.

Please send me Apparatus Bulletin G-180 describing specifications, features and application of Johnson Pneumatic Step Controllers.

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CITY & STATE_____